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DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

WATER-SUPPLY PAPERS

Nos. 207-212

WASHINGTON
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1908

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Water-supply paper 207; Surface water supply of Miss. R., etc., drainages, 1906.
same, 208; Surface water supply of Missouri River drainage, 1906.
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same, 210; Surface water supply of Gulf of Mexico, etc., drainages, 1906.
same, 211; Surface water supply of Colorado R. drainage above Yuma, 1906.
same, 212; Surface water supply of Great Basin drainage, 1906.

Water-Supply and Irrigation Paper No. 207 Series P, Hydrographic Progress Reports, 61

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

SURFACE WATER SUPPLY OF UPPER MISSISSIPPI RIVER AND HUDSON BAY DRAINAGES

1906

A. H. HORTON AND ROBERT FOLLANSBEE
DISTRICT HYDROGRAPHERS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1907

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SURFACE WATER SUPPLY OF UPPER MISSISSIPPI AND HUDSON BAY DRAINAGES, 1906.[a]

A. H. Horton and Robert Follansbee,
District Hydrographers.

INTRODUCTION.

SCOPE OF WORK.

The water supply of the United States is of more importance to the life and pursuits of the people than is any other natural resource. In the arid States the limit of agricultural development is determined by the amount of water available for irrigation; while in all parts of the country the increase in the population of cities and towns makes necessary additional water supplies for domestic and industrial uses, in procuring which both the quantity and the quality of the water that may be obtained must be considered. The location of manufacturing plants may depend largely on the water-power facilities and on the character of the water. The notable advances made in the electric transmission of power have led to the utilization of water powers for the operation of manufacturing establishments, railroads, and municipal lighting plants, many of which are at some distance from the places at which the power is developed.

The intelligent establishment and maintenance of enterprises or industries that depend on the use of water demands a thorough knowledge of the flow of the streams and an understanding of the conditions affecting that flow. This knowledge should be based on data showing both the total flow and the distribution of the flow throughout the year, in order that normal fluctuations may be provided for. As the flow of a stream is variable from year to year, estimates of future flow can be made only from a study of observations covering several years. The rapid increase in the development of the water resources of the United States has caused a great demand by engineers for information in regard to the flow of streams, as it is now

[a] This report contains information similar to that published in previous years under the title "Report of Progress of Stream Measurements."

generally realized that the failure of many large power, irrigation, and other projects has been due to the fact that the plans were made without sufficient trustworthy information in respect to the water supply.

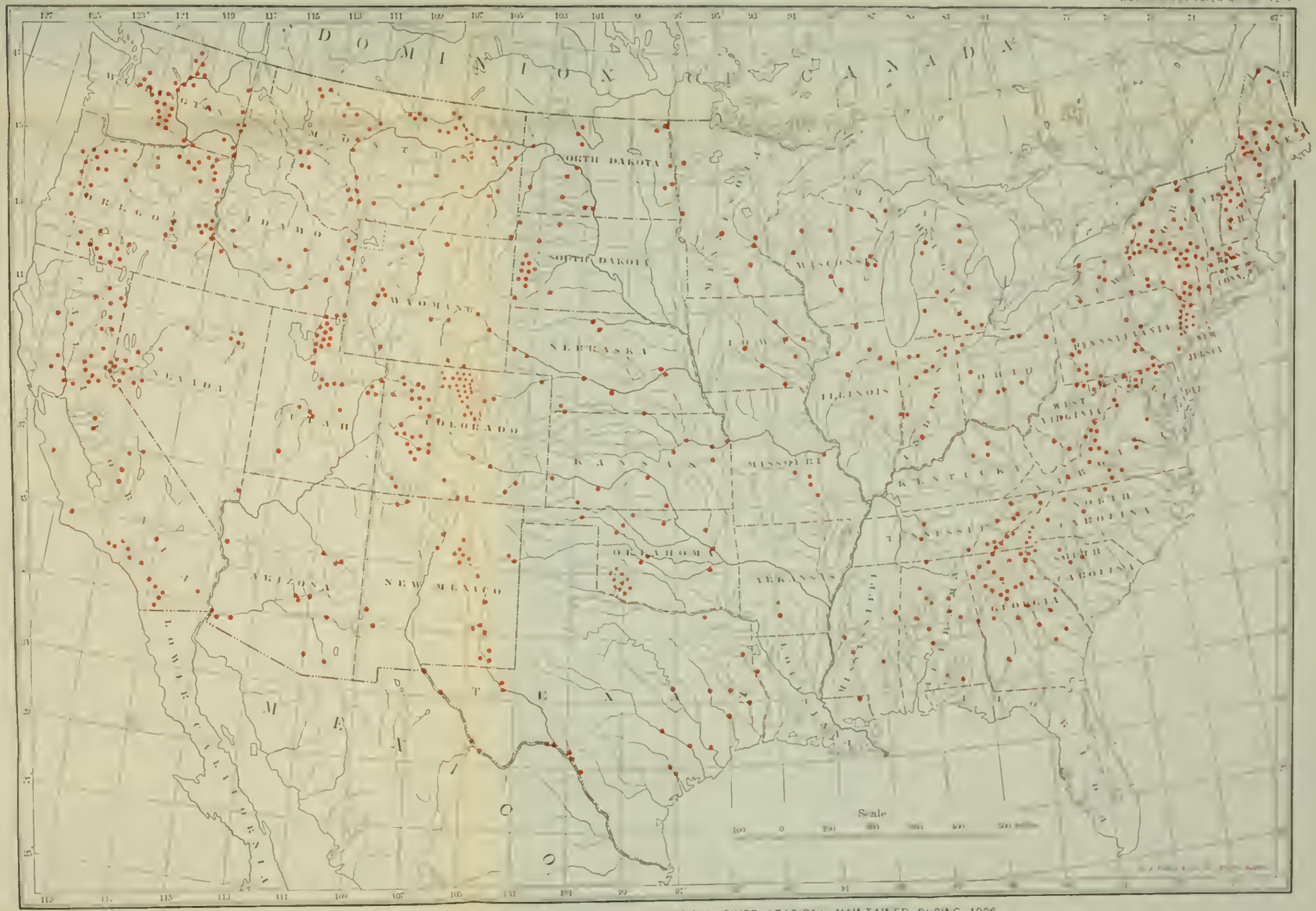
Owing to the broad scope of these hydrographic investigations and the length of time they should cover in order that the records may be of greatest value, it is in general impossible for private individuals to collect the necessary data, and as many of the streams traverse more than one State this work does not properly fall within the province of the State authorities. The United States Geological Survey has therefore, by means of specific appropriations by Congress, for several years systematically made records of stream flow, with the view of ultimately determining all the important features governing the flow of the principal streams of the country. In carrying out this plan stations are established on the streams and maintained for a period long enough to show their regimen or general behavior. When a record that is sufficient for this purpose has been obtained for any stream the work on that stream is discontinued. The order in which the streams are measured is determined by the degree of their importance.

During 1906 the regimen of flow was studied at about 700 stations distributed along the various rivers throughout the United States, as shown on Pl. I. In addition to these records data in regard to precipitation, evaporation, water power, and river profiles were obtained in many sections of the country.

These data have been assembled by drainage areas, and are published in a series of fourteen Water-Supply and Irrigation Papers Nos. 201 to 214, inclusive, each of which pertains to the surface water resources of a group of adjacent areas. In these papers are embodied not only the data collected in the field, but also the results of computations based on these data, and other information that has a direct bearing on the subject, such as descriptions of basins and the streams draining them, utility of the water resources, etc. The list follows:

Water-Supply and Irrigation Papers on Surface Water Supply, 1906.

201. Surface water supply of New England, 1906. (Atlantic Coast of New England drainage.)
202. Surface water supply of the Hudson, Passaic, Raritan, and Delaware river drainages, 1906.
203. Surface water supply of the Middle Atlantic States, 1906. (Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages.)
204. Surface water supply of the Southern Atlantic and Eastern Gulf States, 1906. (Santee, Savannah, Ogeechee, and Altamaha rivers and eastern Gulf of Mexico drainages.)
205. Surface water supply of the Ohio and lower eastern Mississippi river drainages, 1906.



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207. Surface water supply of the upper Mississippi River and Hudson Bay drainage, 1906.
208. Surface water supply of the Missouri River drainage, 1906.
209. Surface water supply of the lower western Mississippi River drainage, 1906.
210. Surface water supply of the western Gulf of Mexico and Rio Grande drainages, 1906.
211. Surface water supply of the Colorado River drainage above Yuma, 1906.
212. Surface water supply of the Great Basin drainage, 1906.
213. Surface water supply of California, 1906. (The Great Basin and Pacific Ocean drainage in California, and Colorado River drainage below Yuma.)
214. Surface water supply of the North Pacific Coast drainages, 1906.

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing such records up to and including 1903 has been published in Water-Supply Paper No. 119. The following table gives, by years and primary drainage basins, the numbers of the papers on the surface water supply, published from 1901 to 1906.

Numbers of water-supply papers containing results of stream measurements, 1901–1906.[a]

	1901.	1902.	1903.	1904.	1905.	1906.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
Atlantic Coast of New England drainage	65 75	82	97	124	165	201
Hudson, Passaic, Raritan, and Delaware river drainages	65 75	82	97	125	166	202
Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages	65 75	82 83	97 98	126	167	203
Santee, Savannah, Ogeechee, and Altamaha river and eastern Gulf of Mexico drainages	65 75	83	98	126	168	204
Ohio and lower eastern Mississippi river drainages	65 75	83	98	128	169	205
Great Lakes and St. Lawrence River drainages	65	83	97	129	170	206
Hudson Bay and upper eastern and western Mississippi River drainages	65 66 75	83 84 85	98 99 100	128 130	171	207
Missouri River drainage	66 75	84	99	130 131	172	208
Meramec, Arkansas, Red, and lower western Mississippi river drainages	66 75	84	99	131	173	209
Western Gulf of Mexico and Rio Grande drainages	66 75	84	99	132	174	210
Colorado River drainage above Yuma	66 75	85	100	133	175	211
The Great Basin drainage	66 75	85	100	133	176	212
The Great Basin and Pacific Ocean drainages in California, and Colorado River drainage below Yuma	66 75	85	100	134	177	213
North Pacific Coast drainages	66 75	85	100	135	178	214

DEFINITIONS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups—(1) those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet

[a] Reports containing data for years prior to 1901 are noted in the series list at the end of this paper.

per square mile, and (2) those which represent the actual quantity of water, as run-off in depth in inches and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the quantity of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed.

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the quantity of water that passes through an orifice 1 inch square under a head which varies locally. It has been commonly used by miners and irrigators throughout the West and is defined by statute in each State in which it is used.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

"Acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. It is commonly used in connection with storage for irrigation work. There is a convenient relation between the second-foot and the acre-foot: One second-foot flowing for twenty-four hours will deliver 86,400 cubic feet, or approximately 2 acre-feet.

EXPLANATION AND USE OF TABLES.

For each regular gaging station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of monthly and yearly discharges and run-off.
6. Tables showing discharge and horsepower and the number of days during the year when the same are available.

The descriptions of stations give such general information about the locality and equipment as would enable the reader to find and use the station, and they also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge-measurement table gives the results of the discharge

measurements made during the year, including the date, the name of the hydrographer, the width and area of cross section, the gage height, and the discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage heights taken each day. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. At most stations the gage is read in the morning and in the evening.

The discharge measurements and gage heights are the base data from which the other tables are computed. In cases of extensive development, it is expected that engineers will use these original data in making their calculations, as the computations made by the Survey are based on the data available at the time they are made and should be reviewed and, if necessary, revised when additional data are available.

The rating table gives the discharge in second-feet, corresponding to various stages of the river, as given by the gage heights. It is published to enable engineers to determine the daily discharge in case this information is desired.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise, in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow for each second during the month. Upon this the computations for the remaining columns, which are defined on page 4, are based.

The values in the table of monthly discharge are intended to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates.

In most work where data in regard to flow are used the regimen of flow is of primary importance. Therefore for the principal stations tables have been prepared showing the horsepower that can be developed at various rates of flow and the length of time that these rates of flow and the corresponding horsepower are available. These tables have been prepared on a basis of 80 per cent efficiency on the turbines, and the horsepower per foot of fall is given in order that the reader can determine the horsepower for any fall.

In the computations sufficient significant figures have been used so that the percentage of error in the tables will not in general exceed 1 per cent. Therefore most of the values in the tables are given to

only three significant figures. In making the various computations Thatcher's slide rule, Crelle's tables, and computation machines have been generally used.

In order to give engineers an idea of the relative value of the various data, notes in regard to accuracy are given as far as possible. This accuracy depends on the general local conditions at the gaging stations and the amount of data collected. Every effort possible is made to so locate the stations that the data collected will give a high degree of accuracy. This is not always possible, but it is considered better to publish rough values with explanatory notes rather than no data.

In the accuracy notes the following terms have been used, indicating the probable accuracy in per cent of the mean monthly flow. As these values are mean values, the error in the value for the flow of any individual day may be much larger.

Excellent indicates that the mean monthly flow is probably accurate to within 5 per cent; good, to within 10 per cent; fair, to within 15 per cent; approximate, to within 25 per cent.

CONVENIENT EQUIVALENTS.

Following is a table of convenient equivalents for use in hydraulic computations:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot quals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second-foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equal 15.7 United States gallons per second
100 California miner's inches equal 96.0 Colorado miner's inches.
100 California miner's inches for one day equal 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches equal 104 California miner's inches.
100 Colorado miner's inches for one day equal 5.17 acre-feet.

100 United States gallons per minute equal 0.223 second-foot.
100 United States gallons per minute for one day equal 0.442 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1⅓ horsepower equal about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11} =$ net horsepower on water wheel, realizing 80 per cent of theoretical power.

FIELD METHODS OF MEASURING STREAM FLOW.

The methods used in collecting these data and in preparing them for publication are given in detail in Water-Supply Papers No. 94 (Hydrographic Manual, U. S. Geological Survey) and No. 95 (Accuracy of Stream Measurements). In order that those who use this report may readily become acquainted with the general methods employed, the following brief descriptions are given:

Streams may be divided, with respect to their physical conditions, into three classes—(1) those with permanent beds; (2) those with beds which change only during extreme low or high water; (3) those with constantly shifting beds. In determining the daily flow special methods are necessary for each class. The data upon which these determinations are based and the methods of collecting them are, however, in general the same.

There are three distinct methods of determining the flow of open-channel streams—(1) by measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir; (3) by measurements of the velocity of the current and the area of the cross section. The method chosen for any case depends upon the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to the coefficients to be used in the Chezy formula, $v = c\sqrt{Rs}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The results obtained by the slope method are, in general, only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value for n to be used in Kutter's formula. The most common use of this method is in determining the flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions.

Weir methods.—When funds are available and the conditions are such that sharp-crested weirs can be erected, these offer the best facilities for determining the flow. If dams are suitably situated and constructed, they may be utilized for obtaining reliable measurements of flow. The conditions necessary to insure good results may be divided into two classes—(1) those relating to the physical characteristics of the dam itself and (2) those relating to the diversion and use of water around and through the dam.

The physical requirements are as follows: (*a*) Sufficient height of dam, so that backwater will not interfere with free fall over it; (*b*) absence of leaks of appreciable magnitude; (*c*) topography or abutments which confine the flow over the dam at high stages; (*d*) level crests, which are kept free from obstructions caused by floating logs or ice; (*e*) crests of a type for which the coefficients to be used in $Q = c\,b\,h^{\frac{3}{2}}$, or some similar standard weir formula are known (see Water-Supply Papers Nos. 180 and 200[a]); (*f*) either no flash boards or exceptional care in reducing leakage through them and in recording their condition.

Preferably there should be no diversion of water through or around the dam. Generally, however, the dam is built for purposes of power or navigation and part or all of the water flowing past it is diverted for such uses. This water is measured and added to that passing over the dam. To insure accuracy in such determinations of flow the amount of water diverted should be reasonably constant. Furthermore, it should be so diverted that it can be measured, either by a weir, a current meter, or a simple system of water wheels which are of standard make, or which have been rated as meters under working conditions, and so installed that the gate openings, the heads under which they work, and their angular velocities may be accurately observed.

The combination of physical conditions and uses of the water should be such that the determinations of flow will not involve, for a critical stage of considerable duration, the use of a head, on a broad-

[a] Water-Supply Paper No. 200 replaces No. 150, the edition of which has been exhausted.

crested dam, of less than 6 inches. Moreover, when all other conditions are good, the cooperation of the owners or operators of the plant is still essential if reliable results are to be obtained.

A gaging station at a weir or dam has the general advantage of continuity of record through the period of ice and floods and the disadvantages of uncertainty of coefficient to be used in the weir formula and of complications in the diversion and use of the water.

Velocity method.—The determination of the quantity of water flowing past a certain section of a stream at a given time is termed a discharge measurement. This quantity is the product of two factors—the mean velocity and the area of the cross section. The mean velocity is a function of surface slope, wetted perimeter, roughness of bed, and the channel conditions at, above, and below the gaging section. The area depends upon the contour of the bed and the fluctuations of the water surface. The two principal ways of measuring the velocity of a stream are by floats and current meters.

Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements in order that the data may have the required degree of accuracy. Their essential requirements are practically the same whether the velocity is determined by meters or floats. They are located as far as possible where the channel is straight both above and below the gaging section; where there are no cross currents, backwater, or boils; where the bed of the stream is reasonably free from large projections of a permanent character; and where the banks are high and subject to overflow only at flood stages. The station must be so far removed from the effects of tributary streams and of dams or other artificial obstructions that the gage height shall be an index of the discharge.

Certain permanent or semipermanent structures usually referred to as equipment are generally pertinent to a gaging station. These are a gage for determining the fluctuations of the water surface, bench marks to which the datum of the gage is referred, permanent marks on a bridge or a tagged line indicating the points of measurement, and, where the current is swift, some appliance (generally a secondary cable) to hold the meter in position in the water. As a rule, the stations are located at bridges if the channel conditions are satisfactory, as from them the observations can more readily be made and the cost of the equipment is small.

The floats in common use are the surface, subsurface, and tube or rod floats. A corked bottle with a flag in the top and weighted at the bottom makes one of the most satisfactory surface floats, as it is affected but little by wind. In case of flood measurements, good results can be obtained by observing the velocity of floating cakes of ice or débris. In case of all surface-float measurements, coefficients must be used to reduce the observed velocity to the mean velocity

The subsurface and tube or rod floats are intended to give directly the mean velocity in the vertical. Tubes give excellent results when the channel conditions are good, as in canals.

In measuring velocity by a float, observation is made of the time taken by the float to pass over the "run," a selected stretch of river from 50 to 200 feet long. In each discharge measurement a large number of velocity determinations are made at different points across the stream, and from these observations the mean velocity for the whole section is determined. This may be done by plotting the mean positions of the floats as indicated by the distances from the bank as ordinates and the corresponding times as abscissas. A curve through these points shows the mean time of run at any point across the stream, and the mean time for the whole stream is obtained by dividing the area bounded by this curve and its axis by the width. The length of the run divided by the mean time gives the mean velocity.

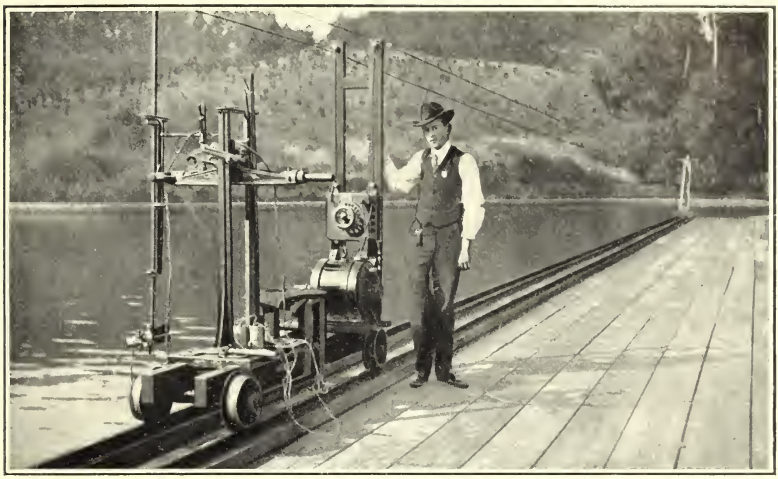
The area used in float measurements is the mean of the areas at the two ends of the run and at several intermediate sections.

The essential parts of the current meters in use are a wheel of some type, so constructed that the impact of flowing water causes it to revolve, and a device for recording or indicating the number of revolutions. The relation between the velocity of the moving water and the revolutions of the wheel is determined for each meter. This rating is done by drawing the meter through still water for a given distance at different speeds and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity per second for any number of revolutions.

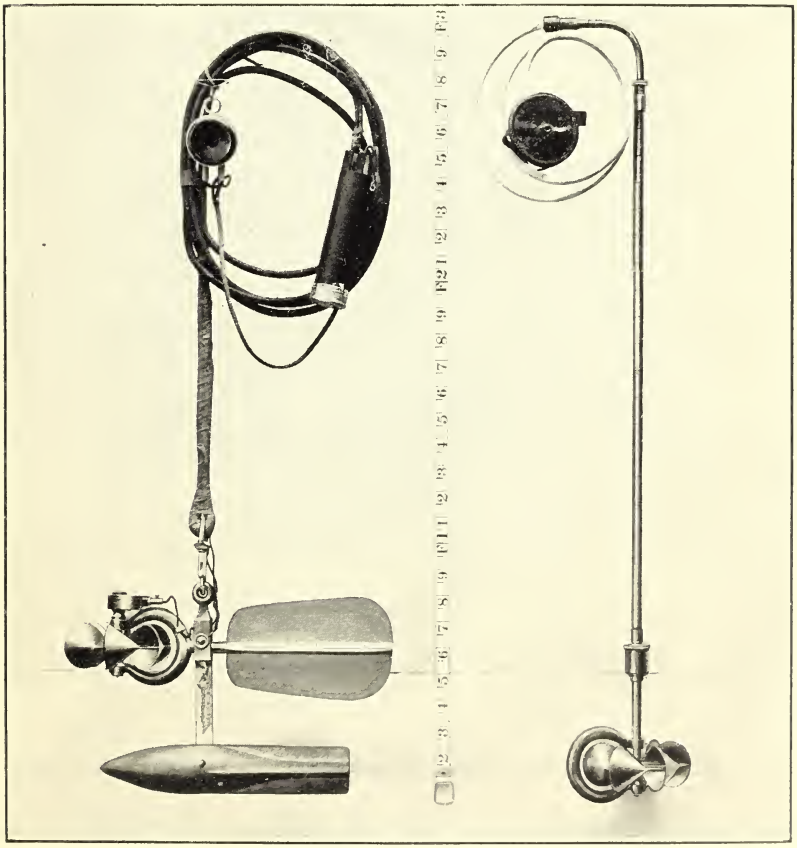
Many kinds of current meters have been constructed. They may, however, be classed in two general types: Those in which the wheel is made up of a series of cups, as the Price, and those having a screw propeller wheel, as the Haskell. Each meter has been developed for use under some special condition. In the case of the small Price meter, shown in Pl. II, *B*, which has been largely developed and has been extensively used by the United States Geological Survey, an attempt has been made to get an instrument which could be used under practically all conditions.

Current-meter measurements may be made from a bridge, a cable, a boat, or by wading, and gaging stations may be classified in accordance with such use. Fig. 1 shows a typical cable station.

In making the measurement an arbitrary number of points are laid off on a line perpendicular to the thread of the stream. The points at which the velocity and depth are observed are known as measuring points, and are usually fixed at regular intervals, varying from 2 to 20 feet, depending upon the size and condition of the stream. Perpendiculars dropped from the measuring points divide the gaging section into strips. For each strip or pair of strips the mean velocity,



A. CURRENT-METER RATING STATION AT LOS ANGELES, CAL.



B. PRICE CURRENT METERS.

area, and discharge are determined independently, so that conditions existing in one part of the stream may not be extended to parts where they do not apply.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

The three principal multiple-point methods in general use are the vertical velocity-curve; 0.2 and 0.8 depth; and top, bottom, and mid-depth.

In the vertical velocity-curve method a series of velocity determinations are made in each vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve among the resulting points, the vertical velocity-curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity-curve and its axis by the depth. On account of the length

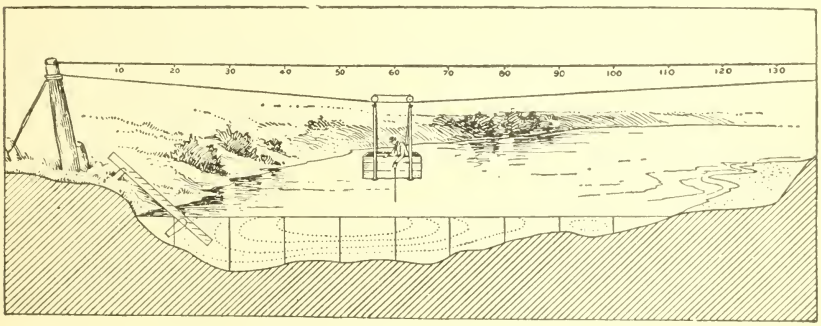


FIG. 1.—Cable station, showing section of river, car, gage, etc.

of time required to make a complete measurement by this method, its use is limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 of the depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity-curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 of the depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this second multiple-point method gives the mean velocity very closely for open-water conditions and, moreover, the indications are that it holds nearly as well for ice-covered rivers.

In the third multiple-point method the meter is held at mid-depth, at 0.5 foot below the surface, and at 0.5 foot above the bottom, and the mean velocity is determined by dividing by 6 the sum of the top

velocity, four times the mid-depth velocity, and the bottom velocity. This method may be modified by observing at 0.2, 0.6, and 0.8 depth.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined.

Extensive experiments by vertical velocity-curves show that the thread of mean velocity generally occurs at from 0.5 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, at which point the meter is held in a majority of the measurements. A large number of vertical velocity-curve measurements taken on many streams and under varying conditions show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be from 0.85 to 0.95, depending upon the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is especially adapted for flood measurements, or when the velocity is so great that the meter can not be kept at 0.6 depth.

The vertical-integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface, and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods.

The area, which is the other factor in the velocity method of determining the discharge of a stream, depends on the stage of the river, which is observed on the gage, and on the general contour of the bed of the stream, which is determined by soundings. The soundings are usually taken at each measuring point at the time of the discharge measurement, either by using the meter and cable or by a special sounding line or rod. For streams with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also of value in obtaining the area for use in computations of high-water measurements, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at various points of measurement, the measuring section is divided into elementary strips, as shown in fig. 1, and the

mean velocity, area, and discharge are determined separately for either a single or a double strip. The total discharge and the area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period, and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8, and vertical velocity-curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, the thickness and character of the ice, etc. From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice. For information in regard to flow under ice cover, see Water-Supply Paper No. 187.

OFFICE METHODS OF COMPUTING RUN-OFF.

There are two principal methods of determining run-off, depending upon whether or not the bed of the stream is permanent.

For stations on streams with permanent beds, the first step in computing the run-off is the construction of a rating table, which shows the discharge corresponding to any stage of the stream. This rating table is applied to the record of stage to determine the amount of water flowing. The construction of the rating table depends upon the method used in measuring flow.

For a station at a weir or dam, the basis for the rating table is some standard weir formula. The coefficients to be used in its application depend upon the type of dam and other conditions near its crest. After inserting in the weir formula the measured length of crest and assumed coefficient, the discharge is computed for various heads and the rating table constructed.

The data necessary for the construction of a rating table for a velocity-area station are the results of the discharge measurements, which include the record of stage of the river at the time of measurement, the area of the cross section, the mean velocity of the current, and the quantity of water flowing. A thorough knowledge of the conditions at and in the vicinity of the station is also necessary.

The construction of the rating table depends upon the following laws of flow for open, permanent channels: (1) The discharge will remain constant so long as conditions at or near the gaging station remain constant; (2) the discharge will be the same whenever the stream is at a given stage if the change of slope due to the rise and fall

of the stream be neglected; (3) the discharge is a function of and increases gradually with the stage.

The plotting of results of the various discharge measurements, using gage heights as ordinates, and discharge, mean velocity, and area as abscissas, will define curves which show the discharge, mean velocity, and area corresponding to any gage height. For the development of these curves there should be therefore a sufficient number of discharge measurements to cover the range of the stage of the stream. Fig. 2 shows a typical rating curve with its corresponding mean-velocity and area curves.

As the discharge is the product of two factors—the area and the mean velocity—any change in either factor will produce a corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate soundings extending to the limits of high water. It is always concave toward the horizontal axis or on a straight line, unless the banks of the stream are overhanging.

The form of the mean-velocity curve depends chiefly upon the surface slope, the roughness of the bed, and the cross section of the stream. Of these the slope is the principal factor. In accordance with the relative changes of these factors the curve may be either a straight line, convex or concave toward either axis, or a combination of the three. From a careful study of the conditions at any gaging station the form which the vertical velocity-curve will take can be predicted, and it may be extended with reasonable certainty to stages beyond the limits of actual measurements. Its principal use is in connection with the area curve in locating errors in discharge measurements and in constructing the rating table.

The discharge curve is defined primarily by the measurements of discharge, which are studied and weighted in accordance with the local conditions existing at the time of each measurement. The curve may, however, best be located between and beyond the measurements by means of curves of area and mean velocity. The discharge curve under normal conditions is concave toward the horizontal axis and is generally parabolic in form.

In the preparation of the rating table the discharge for each tenth or half tenth on the gage is taken from the curve. The differences between successive discharges are then taken and adjusted according to the law that they shall either be constant or increasing.

The determination of daily discharge of streams with changeable beds is a difficult problem. In case there is a weir or dam available, a condition which seldom exists on streams of this class, the discharge can be determined by its use. In case of velocity-area stations frequent discharge measurements must be made if the deter-

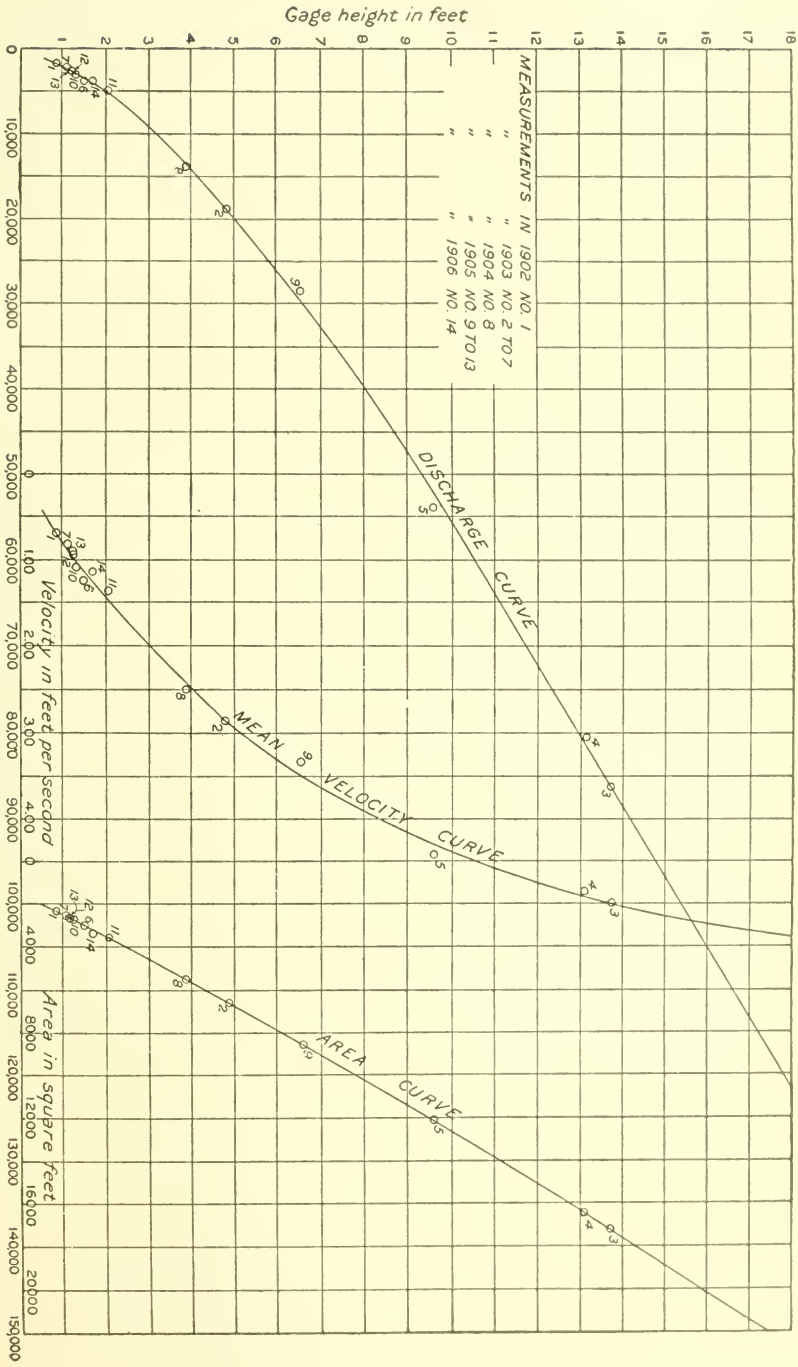


FIG. 2.—Discharge, area, and mean-velocity curves of Potomac River at Point of Rocks, Md.

minations of flow are to be other than rough approximations. For stations with beds which shift slowly or are materially changed only during floods, rating tables can be prepared for periods between such changes and satisfactory results obtained with a limited number of measurements, provided that some of them are taken soon after the change occurs. For streams with continually shifting beds, such as the Colorado and Rio Grande, discharge measurements should be made every two or three days and the discharge for intervening days obtained either by interpolation modified by gage height or by Professor Stout's method, which has been described in full in the Nineteenth Annual Report of the United States Geological Survey, Part IV, page 323, and in the Engineering News of April 21, 1904. This method, or a graphical application of it, is also much used in determining the flow at stations where the bed shifts but slowly.

COOPERATION AND ACKNOWLEDGMENTS.

Assistance has been rendered and records furnished by the following, to whom special acknowledgment is due: D. W. Mead, Madison, Wis.; officers and observers of the U. S. Weather Bureau; the Wisconsin Geological and Natural History Survey, E. A. Birge, director and superintendent.

HUDSON BAY DRAINAGE.

GENERAL FEATURES.

All the waters that reach Hudson Bay from the United States pass through Lake Winnipeg and thence into the bay through Nelson River. The two principal tributaries of Lake Winnipeg, and thus, indirectly, of Nelson River, are the Saskatchewan and Red River. The Saskatchewan drains the major portions of the provinces of Alberta and Saskatchewan and the northwestern part of Assiniboia, in the Dominion of Canada, and, through St. Mary River, a small area in northwestern Montana in the United States. Red River drains a large basin in the United States, covering portions of Minnesota and North and South Dakota. Both rivers are large and important.

ST. MARY RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

St. Mary River heads in northern Montana, near the Canadian boundary line, on the eastern slope of the main range of the Rocky Mountains, in a region of perpetual snow and in the midst of numerous glaciers. It starts from the great Blackfoot glacier, probably the largest in the Rocky Mountains within the United States, and receives affluents from at least a dozen lesser glaciers. These small streams

unite within a short distance from their sources and flow into a lake hemmed in by high mountains, known as Upper St. Mary Lake. Below this lake, separated from it by a narrow strip of land, is Lower St. Mary Lake, the aggregate length of the two lakes being about 22 miles. The river flows out of the lower lake, the elevation of which is 4,460 feet above sea level, and within 2 miles is joined by a stream nearly if not quite as large as itself, known as Swiftcurrent Creek, which is fed by the waters of Grinnell Glacier and four smaller glaciers. From the confluence of these streams to the international boundary, a distance of 12 miles, the St. Mary flows in a northerly direction, receiving Kennedy Creek a few miles before crossing the boundary. Entering the province of Alberta it empties into Belly River, its waters eventually finding their way through the Saskatchewan into Hudson Bay.

A canal has been constructed in Canada by the Canadian Northwest Irrigation Company to divert water from the right bank of St. Mary River, about 5 miles below the international boundary line.

The data collected in the basin are valuable for irrigation purposes.

ST. MARY RIVER NEAR BABB, MONT.[a]

This station was established April 9, 1902. It is located at Henry Henkel's ranch, about 1 mile east of his house and 35 miles northwest of Browning, Mont. It is also about 4,500 feet below the foot of Lower St. Mary Lake. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 17, where are given also references to publications that contain data for previous years.

Discharge measurements of St. Mary River near Babb, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 31	Freeman and Edson	50	50	1.40	66
May 11	W. B. Freeman	92	172	2.92	[a] 631
August 18	Morse and Hartman	90	161	2.82	629
September 14	Richards and Hartman	88	132	2.42	420

[a] Meter probably not in good order, causing results to be too low.

Daily gage height, in feet, of St. Mary River near Babb, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.9	1.9	1.4	1.5	2.8	3.3	3.7	3.0	2.8	2.2	3.0	2.7
2	1.9	1.9	1.4	1.5	2.8	3.3	3.7	3.0	2.8	2.1	3.1	2.6
3	1.9	1.9	1.4	1.5	2.9	3.5	3.7	2.9	2.8	2.2	3.1	2.6
4	1.9	1.9	1.4	1.5	2.9	3.6	3.7	2.9	2.8	2.1	3.1	2.5
5	1.9	1.9	1.4	1.6	2.9	3.7	3.8	2.9	2.7	2.2	3.0	2.5
6	1.9	1.9	1.5	1.6	2.9	3.8	3.8	2.9	2.7	2.1	2.9	2.4
7	1.9	1.9	1.5	1.6	2.9	3.8	3.9	2.8	2.7	2.2	2.8	2.4
8	1.9	1.9	1.5	1.6	2.9	3.9	3.9	2.8	2.7	2.1	2.9	2.4
9	1.9	1.9	1.5	1.6	2.9	3.9	4.0	2.8	2.7	2.3	2.7	2.3
10	1.9	1.9	1.5	1.6	3.0	3.9	4.0	2.8	2.6	2.2	2.2	2.7

[a] Formerly dam site.

Daily gage height, in feet, of St. Marg River near Babb, Mont., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	1.9	1.9	1.7	1.6	3.0	3.9	4.1	2.7	2.6	2.3	2.8	2.0
12	1.9	1.9	1.7	1.6	3.0	3.9	4.1	2.7	2.5	2.2	2.8	2.0
13	1.9	1.9	1.7	1.7	3.1	4.0	4.2	2.7	2.5	2.3	2.9	2.0
14	1.9	1.9	1.7	1.7	3.3	4.1	4.1	2.7	2.4	2.2	2.9	2.0
15	1.9	1.9	1.7	1.7	3.4	4.2	4.1	2.7	2.4	2.4	3.0	2.0
16	1.9	1.9	1.7	1.7	3.6	4.3	4.0	2.7	2.4	2.3	3.0	2.0
17	1.9	1.9	1.7	1.7	3.5	4.0	3.9	2.8	2.4	2.4	3.1	2.0
18	1.9	1.9	1.5	1.7	3.5	4.0	3.8	2.8	2.3	2.4	3.0	1.9
19	1.9	1.9	1.5	1.8	3.4	4.0	3.7	2.8	2.3	2.5	3.0	1.9
20	1.9	1.4	1.6	1.8	3.4	3.9	3.6	2.9	2.3	2.4	3.0	1.9
21	1.9	1.4	1.6	1.9	3.3	3.9	3.5	2.9	2.2	2.6	2.9	1.9
22	1.9	1.4	1.6	2.0	3.3	3.8	3.5	3.0	2.2	2.5	2.9	1.9
23	1.9	1.4	1.6	2.1	3.3	3.7	3.4	3.0	2.2	2.6	2.9	1.9
24	1,9	1.4	1.6	2.2	3.2	3.7	3.4	3.0	2.2	2.6	2.9	1.8
25	1.9	1.4	1.6	2.3	3.2	3.6	3.3	3.1	2.2	2.7	2.8	1.8
26	1.9	1.4	1.5	2.5	3.3	3.6	3.2	3.0	2.2	2.6	2.8	1.8
27	1.9	1.4	1.5	2.6	3.3	3.5	3.2	3.0	2.1	2.7	2.8	1.8
28	1.9	1.4	1.4	2.7	3.3	3.6	3.1	3.0	2.1	2.7	2.7	1.8
29	1.9	.....	1.4	2.7	3.3	3.6	3.1	2.9	2.1	2.8	2.7	1.8
30	1.9	.....	1.4	2.7	3.3	3.7	3.3	2.9	2.1	2.8	2.7	1.8
31	1.9	.....	1.4	.....	3.3	.....	3.3	2.8	.....	3.0	.....	1.8

NOTE.—Ice conditions January 1 to February 19, March 11 to 26; gage heights to surface of ice. Practically open-channel condition during December.

Rating table for St. Mary River near Babb, Mont., for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	65	2.20	325	3.00	725	3.80	1,300
1.50	90	2.30	365	3.10	790	3.90	1,380
1.60	115	2.40	410	3.20	855	4.00	1,460
1.70	145	2.50	455	3.30	925	4.10	1,545
1.80	175	2.60	505	3.40	995	4.20	1,630
1.90	210	2.70	555	3.50	1,070	4.30	1,715
2.00	245	2.80	610	3.60	1,145		
2.10	285	2.90	665	3.70	1,220		

NOTE.—The above table is applicable only for open-channel conditions. It is based upon 11 discharge measurements made during 1905 and 1906. It is well defined between gage heights 1.4 and 4 feet.

Monthly discharge of St. Mary River near Babb, Mont., for 1906.

[Drainage area, 177 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	.....	.....	[a] 70	4,300	0.396	0.46
February	.....	.....	[a] 65	3,610	.367	.38
March [b]	90	65	82.7	5,080	.467	.54
April	555	90	218	13,000	1.23	1.37
May	1,140	610	841	51,700	4.75	5.48
June	1,720	925	1,300	77,400	7.34	8.19
July	1,630	790	1,220	75,000	6.89	7.94
August	790	555	649	39,900	3.67	4.23
September	610	285	432	25,700	2.44	2.72
October	725	285	421	25,900	2.38	2.74
November	790	555	666	39,600	3.76	4.20
December	555	175	283	17,400	1.60	1.84
The year	1,720	.....	521	379,000	2.94	40.09

[a] Discharge January 1 to February 19 estimated by C. C. Babb.
[b] Discharge estimated March 11 to 25.

NOTE.—Values are rated as follows: January and February, approximate; April to November, excellent; March, fair; December, good.

ST. MARY RIVER NEAR CARDSTON, ALBERTA.

This station was established September 4, 1902, near Shaw's ranch, one-fourth mile north of the boundary line between the United States and Canada and 17 miles south of Cardston, Alberta. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 19, where are given also references to publications that contain data for previous years.

Discharge measurements of St. Mary River near Cardston, Alberta, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 1	Freeman and Edson	90	126	2.90	138
May 12	W. B. Freeman	108	341	5.10	[a] 1,350
August 20	do	105	249	4.29	746
September 13	Richards and Hartman	102	231	4.13	650

[a] Meter probably not in good order, causing result to be too low.

Daily gage height, in feet, of St. Mary River near Cardston, Alberta, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec
1	3.5	4.25	3.75	.....	4.6	5.45	5.45	4.65	4.55	3.7	4.8	4.05
2	3.5	4.25	3.8	2.95	4.65	.....	5.4	4.5	4.55	3.75	.....	4.05
3	3.5	.....	4.1	2.95	4.7	5.6	5.4	4.5	4.45	3.85	4.6	4.0
4	3.75	4.45	4.2	3.0	.....	5.65	5.45	4.45	4.45	4.0	4.5	3.95
5	3.75	4.5	.....	3.05	4.7	5.75	5.5	4.4	4.4	4.1	4.5	3.9
6	3.75	4.6	3.85	3.1	4.7	5.75	5.5	4.3	4.35	4.15	4.45	3.9
7	3.75	4.6	3.7	3.15	4.65	5.7	5.5	4.25	4.3	4.15	.....	3.8
8	3.75	4.65	3.6	3.25	4.65	5.55	5.5	4.25	4.3	4.1	4.35	3.7
9	.....	4.65	3.6	3.3	4.7	5.55	5.6	4.2	4.3	4.05	4.3	3.75
10	3.75	4.65	3.5	3.3	4.75	5.55	5.6	4.2	4.25	4.1	4.3	3.7
11	3.75	4.7	.....	3.3	4.8	5.55	5.6	4.2	4.2	.....	4.3	3.6
12	3.75	4.7	.....	3.35	5.0	5.75	5.6	4.25	4.15	4.1	4.5	.....
13	3.75	4.7	4.4	3.35	5.1	.....	5.6	4.3	4.15	4.1	4.6	3.5
14	3.75	4.7	4.45	.....	5.25	5.7	5.4	4.35	4.05	4.1	4.7	3.4
15	3.75	4.7	4.5	3.35	5.35	5.6	5.35	4.4	4.0	4.1	5.05	3.35
16	3.75	4.7	4.55	3.4	5.3	5.6	5.3	4.4	3.95	4.1	.....	.....
17	3.75	4.7	.....	3.5	5.3	5.5	5.2	.....	3.9	4.1	.....	3.3
18	3.75	4.7	4.6	3.55	5.1	5.55	5.25	4.35	3.85	4.1	5.1	3.3
19	3.75	4.5	4.6	3.65	5.05	5.4	5.2	4.35	3.8	.....	5.1	3.3
20	3.75	4.5	4.6	3.75	5.05	5.35	5.15	4.3	3.8	4.2	4.9	3.35
21	3.75	4.5	4.6	3.8	5.0	5.25	5.05	4.35	.....	4.15	4.95	3.35
22	3.75	4.5	4.6	4.05	5.05	5.35	5.0	4.5	3.8	4.1	4.85	3.4
23	3.75	4.5	4.5	4.25	5.05	5.45	4.95	4.6	3.8	4.1	4.8	3.45
24	3.8	4.5	4.5	4.6	5.1	5.3	4.95	4.75	3.85	4.1	4.7	3.45
25	4.0	4.35	4.45	4.6	.....	5.25	4.9	4.95	3.85	4.1	4.55	3.5
26	.....	4.3	4.3	4.65	5.15	.....	4.85	.....	3.85	4.5	4.5	3.5
27	4.25	4.2	4.2	4.65	5.15	5.55	4.85	4.85	3.8	4.75	4.4	3.45
28	4.15	.....	3.3	4.65	5.2	5.65	4.75	4.8	3.7	5.0	4.35	3.4
29	4.2	.....	.....	.....	5.25	5.5	4.65	4.7	3.7	5.0	4.2	3.3
30	4.2	.....	.....	4.55	5.25	5.55	.....	4.65	3.65	4.95	4.15	.....
31	4.25	.....	2.90	.....	5.3	.....	4.65	4.6	.....	4.85	.....	.....

NOTE.—Ice conditions January 1 to March 31; river frozen to bottom during greater portion of ice period; gage heights are to ice surface, except for short periods when water overflowed ice. Ice conditions December 9 to 31; gage readings to water surface.

Rating table for St. Mary River near Cardston, Alberta, for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.90	153	3.70	410	4.50	960	5.30	1,900
3.00	174	3.80	460	4.60	1,055	5.40	2,055
3.10	198	3.90	515	4.70	1,155	5.50	2,215
3.20	225	4.00	575	4.80	1,260	5.60	2,385
3.30	255	4.10	640	4.90	1,370	5.70	2,565
3.40	288	4.20	710	5.00	1,490	5.80	2,755
3.50	325	4.30	785	5.10	1,620		
3.60	365	4.40	870	5.20	1,755		

NOTE.—The above table is applicable only for open-channel conditions. It is based upon 22 discharge measurements made during 1902–1906. It is well defined between gage heights 2.5 feet and 7 feet.

Monthly discharge of St. Mary River near Cardston, Alberta, for 1906.

[Drainage area, 452 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January			[a] 100	6,150	0.221	0.25
February			[a] 95	5,280	.210	.22
March			[b] 125	7,690	.277	.32
April	1,100	160	481	28,600	1.06	1.18
May	1,990	1,060	1,500	92,200	3.32	3.83
June	2,660	1,830	2,280	136,000	5.04	5.62
July	2,380	1,100	1,830	113,000	4.05	4.67
August	1,430	710	946	58,200	2.09	2.41
September	1,010	385	628	37,400	1.39	1.55
October	1,490	410	756	46,500	1.67	1.92
November	1,620	675	1,100	65,500	2.43	2.71
December [c]	607	255	359	22,100	.794	.92
The year	2,660		850	619,000	1.88	25.60

[a] January and February estimated by C. C. Babb.
[b] Estimated from flow of St. Mary and Swiftcurrent near Babb, Mont.
[c] Flow only slightly affected by ice conditions.

NOTE.—Values are rated as follows: January and February, approximate; March, fair; April to November, excellent; December, good.

SWIFTCURRENT CREEK NEAR BABB, MONT.

This station was established April 8, 1902. It is located one-half mile northwest of Henkel's ranch and 36 miles northwest of Browning, Mont. The nearest post-office is at Babb, Mont., 2 miles below. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 21, where are given also references to publications that contain data for previous years. The length of the chain is now 15.90 feet.

Discharge measurements of Swiftcurrent Creek near Babb, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 31	Freeman and Edson	30	30	2.08	48
May 12	W. B. Freeman	55	108	3.60	[a] 501
August 18	Morse and Hartman	55	71	2.73	233
September 14	Richards and Hartman	50	53	2.38	146

[a] Meter probably out of order, causing result to be too low.

Daily gage height, in feet, of Swiftcurrent Creek near Babb, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.3	2.3	1.7	2.1	3.2	3.3	3.4	2.7	2.8	2.4	3.2	2.6
2	2.3	2.3	1.7	2.1	3.1	3.3	3.3	2.7	2.8	2.4	3.0	2.5
3	2.3	2.3	1.7	2.2	3.1	3.5	3.3	2.7	2.7	2.5	2.9	2.4
4	2.3	2.3	1.7	2.2	3.2	3.9	3.3	2.7	2.7	2.5	2.9	2.4
5	2.3	2.3	1.8	2.3	3.3	3.8	3.4	2.7	2.7	2.6	2.9	2.3
6	2.3	2.3	1.8	2.4	3.3	3.6	3.4	2.6	2.7	2.7	2.9	2.3
7	2.3	2.3	1.9	2.5	3.2	3.5	3.4	2.6	2.6	2.6	2.8	2.3
8	2.3	2.3	1.9	2.6	3.2	3.5	3.4	2.6	2.6	2.6	2.8	2.3
9	2.3	2.3	1.9	2.8	3.1	3.5	3.3	2.6	2.6	2.6	2.8	2.1
10	2.3	2.3	1.9	2.8	3.3	3.6	3.3	2.5	2.7	2.6	2.8	2.1
11	2.3	2.3	2.3	2.8	3.4	3.8	3.3	2.5	2.7	2.7	2.9	2.0
12	2.3	2.3	2.3	2.7	3.6	3.9	3.3	2.5	2.6	2.7	2.9	2.0
13	2.3	2.3	2.3	2.7	3.6	4.1	3.2	2.5	2.5	2.7	2.9	2.0
14	2.3	2.3	2.3	2.6	3.6	3.9	3.2	2.5	2.4	2.7	3.0	2.0
15	2.3	2.3	2.3	2.7	3.7	3.7	3.1	2.6	2.4	2.7	3.0	2.0
16	2.3	2.3	2.3	2.7	3.7	3.5	3.1	2.6	2.4	2.7	3.1	2.0
17	2.3	2.3	2.3	2.8	3.5	3.5	3.0	2.6	2.3	2.7	3.3	2.0
18	2.3	2.3	2.3	2.8	3.4	3.4	3.0	2.6	2.3	2.7	3.2	2.0
19	2.3	2.3	2.3	2.9	3.1	3.4	3.0	2.6	2.3	2.7	3.1	2.0
20	2.3	2.3	2.3	2.9	3.1	3.3	2.9	2.7	2.2	2.7	3.1	1.9
21	2.3	1.6	2.3	3.0	3.2	3.3	2.9	2.7	2.2	2.9	3.0	1.9
22	2.3	1.6	2.3	3.3	3.2	3.3	2.9	2.8	2.2	3.0	3.0	1.8
23	2.3	1.6	2.3	3.5	3.3	3.3	2.8	2.8	2.2	3.0	2.9	1.8
24	2.3	1.6	2.3	3.5	3.3	3.3	2.8	2.8	2.2	3.2	2.8	1.8
25	2.3	1.6	2.3	3.5	3.3	3.3	2.8	2.9	2.2	3.6	2.8	1.8
26	2.3	1.6	1.9	3.4	3.3	3.4	2.8	2.9	2.3	3.7	2.8	1.7
27	2.3	1.6	2.0	3.4	3.3	3.4	2.7	2.9	2.3	3.9	2.7	1.7
28	2.3	1.6	2.0	3.3	3.3	3.4	2.7	2.8	2.3	3.9	2.6	1.7
29	2.3	.....	2.0	3.3	3.3	3.5	2.7	2.8	2.3	3.9	2.6	1.7
30	2.3	.....	2.1	3.2	3.3	3.5	2.7	2.8	2.4	3.7	2.6	1.7
31	2.3	.....	2.1	.....	3.3	.....	2.7	2.8	.....	3.5	.....	1.7

NOTE.—Ice conditions January 1 to February 20, March 11 to 25, readings are to top of ice. Practically open-channel conditions during December.

Rating table for Swiftcurrent Creek near Babb, Mont., for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.70	7	2.40	130	3.10	385	3.80	800
1.80	18	2.50	160	3.20	435	3.90	875
1.90	30	2.60	190	3.30	485	4.00	950
2.00	44	2.70	225	3.40	540	4.10	1,025
2.10	60	2.80	260	3.50	600	4.20	1,100
2.20	80	2.90	300	3.60	665	4.30	1,175
2.30	105	3.00	340	3.70	730		

NOTE.—The above table is applicable only for open-channel conditions. It is based upon 11 discharge measurements made during 1905 and 1906. It is well defined between gage heights 2.1 feet and 4.5 feet.

Monthly discharge of Swiftcurrent Creek near Babb, Mont., for 1906.

[Drainage area, 101 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	.....	.....	[a] 30	1,840	0.297	0.34
February	.....	.....	[a] 30	1,670	.297	.31
March	60	7	[b] 29.5	1,810	.292	.34
April	600	60	299	17,800	2.96	3.30
May	730	385	500	30,700	4.95	5.71
June	1,020	485	623	37,100	6.17	6.88
July	540	225	381	23,400	3.77	4.35
August	300	160	220	13,500	2.18	2.51
September	260	80	151	8,980	1.50	1.67
October	875	130	347	21,300	3.44	3.97
November	485	190	308	18,300	3.05	3.40
December	190	7	55.5	3,410	.550	.63
The year	1,020	7	248	180,000	2.45	33.41

[a] January and February estimated by C. C. Babb. [b] Discharge estimated March 11 to 25.

NOTE.—Values are rated as follows: January to March, approximate; April to November, excellent; December, good.

KENNEDY CREEK NEAR BABB, MONT.

This station was established October 17, 1903. It is located 50 feet above the ford on the road from Altyn, Mont., to Cardston, Alberta, and is 37 miles northwest of Browning, Mont., and about 4 miles north of Babb post-office. The station is situated where the creek emerges from the canyon, about 1½ miles above its confluence with St. Mary River. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 24, where are given also references to publications that contain data for previous years.

Discharge measurements of Kennedy Creek near Babb, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 31	Freeman and Edson	19	19	5.74	28.7
May 12	W. B. Freeman	57	72	6.38	[a] 17.2
August 18	Morse and Hartman	50	34	5.78	49.4
September 14	Richards and Hartman	51	43	5.91	66.4

[a] Meter probably out of order, causing result to be too low.

RED RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Red River rises in Lake Traverse, on the boundary line between South Dakota and Minnesota, and flows almost due north into Lake Winnipeg, its waters finally reaching Hudson Bay through Nelson River. It drains a large area in the United States, including portions of Minnesota and of South and North Dakota.

The basin is characterized by level topography, broken in places by moraines and other glacial deposits. The greater part of it is prairie land, and its eastern half comprises some woods and a great abundance of lakes. The main river has cut a deep channel in its broad, level valley, which includes about 9,000,000 acres of excellent agricultural land. The heavy spring rains cause sudden freshets, which frequently entail considerable loss of life and property. The principal tributaries of the stream from the United States are Sheyenne and Pembina rivers from the west and Ottertail and Red Lake rivers from the east. Mouse River drains into it through Assiniboine River. A number of water powers have been developed during recent years on tributaries from both sides.

The data collected in this basin are valuable for water power and drainage purposes.

RED RIVER AT FARGO, N. DAK.

This station was established May 27, 1901. It is located at the bridge connecting Front street, Fargo, N. Dak., with Main street, Moorhead, Minn. Gage heights are furnished by the United States Weather Bureau. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 27, where are given also references to publications that contain data for previous years.

Discharge measurements of Red River at Fargo, N. Dak., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
November 18	R. Richards	108	410	8.84	760
1906.					
April 14	E. F. Chandler	90	690	13.69	[a] 2,390
June 27	do	120	774	12.03	1,630
September 10	do	110	533	10.04	971
October 27	do	112	567	10.20	987

[a] At Northern Pacific Railway bridge.

Daily gage height, in feet, of Red River at Fargo, N. Dak., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	8.6	8.6	9.8	12.6	10.9	12.7	12.2	10.9	11.1	10.5	10.6	11.0
2				13.2	11.0	12.5	12.2	11.1	10.9	10.4	10.6	
3				13.4	11.1	12.4	12.5	11.4	10.7	10.3	10.6	
4				13.5	11.2	12.2	12.6	11.3	10.6	10.2	10.5	
5				13.5	11.3	12.1	12.7	11.4	10.5	10.1	10.5	
6				13.7	11.4	12.0	12.7	11.5	10.4	10.0	10.4	
7				14.1	11.4	12.1	12.7	11.4	10.2	10.0	10.4	
8			10.2	14.9	11.4	12.1	12.6	11.3	10.0	9.9	10.3	
9			10.8	15.5	11.3	12.2	12.5	11.2	10.0	9.8	10.2	
10			11.2	14.9	11.2	12.2	12.3	11.1	10.0	9.6	10.1	
11				13.3	11.1	12.3	12.2	11.0	10.1	9.6	10.1	
12		8.6		12.3	11.2	12.2	12.0	10.9	10.0	9.6	10.1	
13				12.4	10.9	12.1	11.8	10.8	9.9	9.5	10.1	
14				13.5	10.8	12.0	11.8	10.7	9.9	9.5	10.0	
15				14.2	10.7	12.0	11.8	10.6	9.9	9.5	10.0	

Daily gage height, in feet, of Red River at Fargo, N. Dak., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	.....	.....	.....	14.5	12.5	12.0	11.6	10.5	9.9	9.3	9.4	.....
17	.....	.....	.....	14.9	14.0	11.9	11.5	10.4	9.9	9.5	9.8	.....
18	.....	.....	.....	15.0	13.8	12.0	11.5	10.6	9.9	9.5	9.6	.....
19	.....	.....	.....	14.5	13.3	12.0	11.5	10.8	9.9	9.5	9.4	.....
20	.....	.....	10.0	13.7	12.7	12.0	11.4	10.8	10.0	9.3	9.2	.....
21	.....	.....	.....	12.9	12.4	12.0	11.3	10.8	10.0	9.3	.....	.....
22	.....	9.8	.....	11.0	12.2	11.9	11.2	10.9	10.2	9.3	.....	.....
23	.....	.....	.....	11.8	12.1	11.9	11.1	10.8	10.4	9.4	.....	.....
24	.....	.....	.....	11.5	12.0	11.8	11.1	10.8	10.5	9.5	.....	10.5
25	.....	.....	10.0	11.2	11.9	11.8	11.0	10.9	10.8	9.6	.....	.....
26	.....	.....	10.0	11.0	12.1	12.0	10.9	10.9	10.8	10.0	.....	.....
27	.....	.....	10.0	10.9	12.8	12.0	10.9	10.9	10.8	10.2	9.6	.....
28	.....	.....	10.2	10.8	12.5	12.0	10.9	11.0	10.7	10.5	9.8	.....
29	.....	.....	10.5	10.8	12.7	12.2	10.9	11.1	10.6	10.6	10.4	.....
30	.....	.....	11.5	10.8	12.8	12.2	10.9	11.3	10.6	10.6	11.0	.....
31	.....	.....	12.1	.....	12.9	.....	10.9	11.3	.....	10.6	.....	.....

NOTE.—Ice conditions January 1 to April 6 and November 21 to December 31; ice 2 to 3 feet thick during first part of year and 0.5 to 1.5 feet during latter part of year.

Rating table for Red River at Fargo, N. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
8.80	653	10.10	1,008	11.40	1,429	13.40	2,185
8.90	678	10.20	1,038	11.50	1,464	13.60	2,266
9.00	703	10.30	1,069	11.60	1,499	13.80	2,348
9.10	729	10.40	1,100	11.70	1,535	14.00	2,430
9.20	755	10.50	1,131	11.80	1,571	14.20	2,512
9.30	781	10.60	1,163	11.90	1.607	14.40	2,594
9.40	808	10.70	1,195	12.00	1,644	14.60	2,676
9.50	835	10.80	1,227	12.20	1,718	14.80	2,758
9.60	863	10.90	1,260	12.40	1,793	15.00	2,840
9.70	891	11.00	1,293	12.60	1,869	16.00	3,260
9.80	920	11.10	1,326	12.80	1,947		
9.90	949	11.20	1,360	13.00	2,025		
10.00	978	11.30	1,394	13.20	2,105		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 4 discharge measurements made during 1906 and a number of older measurements. It is fairly well defined.

Monthly discharge of Red River at Fargo, N. Dak., for 1906.

[Drainage area, 6,020 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April[a]	3,050	1,230	2,050	122,000	0.341	0.38
May	2,430	1,200	1,630	100,000	.271	.31
June	1,910	1,570	1,680	100,000	.279	.31
July	1,910	1,260	1,550	95,300	.257	.30
August	1,460	1,100	1,290	79,300	.214	.25
September	1,330	949	1,070	63,700	.178	.20
October	1,160	781	940	57,800	.156	.18
November[b]	1,160	.....	942	56,100	.156	.17
The period	.....	.....	.....	674,000	.....	.....

[a] River not materially affected by ice conditions first week in April.
[b] Discharge estimated November 21 to 30.

NOTE.—Values are rated as follows: April, good; May to October, excellent; November, fair.

RED RIVER AT GRAND FORKS, N. DAK.

This station was established May 26, 1901. It is located at the Northern Pacific Railway bridge at Grand Forks, N. Dak. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 29, where are given also references to publications that contain data for previous years.

Discharge measurements of Red River at Grand Forks, N. Dak., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
December 22	E. F. Chandler	208	1,110	[a] 9.05	[b] 1,840
1906.					
January 29	Chandler and Richards	207	1,060	[c] 9.45	[b] 1,770
March 5	do	205	949	[d] 9.51	[b] 1,550
March 23	do	207	1,110	[e] 10.24	[b] 1,880
April 9	R. Richards	576	9,140	32.40	23,000
August 11	E. F. Chandler	161	1,510	10.27	3,710
November 5	do	160	1,140	8.21	2,410
December 21	do	198	1,070	[f] 8.59	[b] 1,700

[a] Gage height to under side of ice=8.02.
[b] Ice measurements; gage heights are to the water surface in a hole in the ice.
[c] Gage height to under side of ice=7.79.
[d] Gage height to under side of ice=7.01.
[e] Gage height to under side of ice=7.82.
[f] Gage height to under side of ice=7.71.

Daily gage height, in feet, of Red River at Grand Forks, N. Dak., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1				17.8	18.5	16.4	13.1	9.6	8.7	8.4	7.9	8.8
2				21.9	17.8	16.3	13.2	9.9	9.1	8.5	8.35	
3		9.5	9.5	25.1	17.4	16.1	13.25	10.1	9.15	8.4	8.35	
4				27.9	17.25	15.8	13.8	10.4	9.2	8.25	8.3	
5			9.5	30.55	17.25	15.4	14.4	10.6	9.05	8.3	8.25	
6	9.35			32.5	17.25	15.25	14.65	10.25	8.9	8.4	8.4	
7				33.5	17.2	15.1	14.4	10.85	8.55	8.45	8.05	
8				33.3	17.1	14.75	14.15	10.8	8.4	8.3	8.1	8.9
9				32.25	16.9	14.5	13.85	10.6	8.3	8.1	8.2	
10		9.35	9.7	31.0	16.7	14.35	13.5	10.5	8.3	7.85	8.5	
11				30.1	16.35	14.2	13.0	10.25	8.3	8.0	8.25	
12				29.25	16.0	14.2	12.75	10.1	8.2	7.85	8.25	
13	9.2			28.9	15.65	14.0	12.35	9.85	8.25	7.8	8.1	
14				29.5	15.25	13.85	11.95	9.65	8.1	7.7	8.1	
15				31.1	15.5	13.65	11.65	9.55	7.9	7.8	8.1	8.4
16				34.0	16.15	13.3	11.3	9.4	7.8	7.7	7.6	
17		9.2	10.3	35.5	16.75	13.0	11.1	9.3	7.8	7.6	7.2	
18				36.0	16.75	12.85	10.85	9.2	7.9	7.7	7.15	
19				35.85	16.9	12.8	10.7	9.05	7.85	7.6	7.4	
20	9.4			35.15	17.2	13.1	10.5	9.0	8.0	7.55		
21				34.2	17.1	13.35	10.45	9.0	7.95	7.55	7.5	
22				32.9	17.05	13.3	10.5	9.0	8.0	7.45		8.4
23			10.2	31.2	16.85	13.1	10.25	8.95	8.1	7.4		
24		9.15	10.1	29.4	16.7	13.0	10.15	9.0	8.1	7.35	7.6	
25				27.35	16.45	12.9	10.2	9.15	8.2	7.3		
26				25.5	16.3	12.8	10.2	9.1	8.6	7.25		
27	9.5			23.55	16.7	12.85	10.2	8.9	8.65	7.3		
28				22.0	17.25	13.15	10.0	8.95	8.55	7.4		
29	9.45			20.55	17.35	13.2	9.8	9.2	8.4	7.7		8.4
30				19.4	17.05	13.2	9.8	9.15	8.5	8.4		
31			14.0		16.8		9.7	8.8		7.6		

NOTE.—Ice conditions January 1 to April 8; gage heights were to water surface; average ice thickness, 2 feet. Ice condition November 13 to December 31; average thickness 1.1 feet.

Rating table for Red River at Grand Forks, N. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
7.00	1,800	8.80	2,700	11.20	4,140	22.00	12,790
7.10	1,846	8.90	2,755	11.40	4,270	23.00	13,730
7.20	1,892	9.00	2,810	11.60	4,400	24.00	14,670
7.30	1,939	9.10	2,865	11.80	4,530	25.00	15,640
7.40	1,986	9.20	2,920	12.00	4,660	26.00	16,640
7.50	2,034	9.30	2,975	12.20	4,790	27.00	17,650
7.60	2,082	9.40	3,030	12.40	4,920	28.00	18,670
7.70	2,131	9.50	3,090	12.60	5,060	29.00	19,720
7.80	2,180	9.60	3,150	12.80	5,200	30.00	20,790
7.90	2,230	9.70	3,210	13.00	5,340	31.00	21,880
8.00	2,280	9.80	3,270	14.00	6,040	32.00	22,980
8.10	2,330	9.90	3,330	15.00	6,790	33.00	24,100
8.20	2,380	10.00	3,390	16.00	7,560	34.00	25,250
8.30	2,430	10.20	3,510	17.00	8,360	35.00	26,400
8.40	2,480	10.40	3,630	18.00	9,190	36.00	27,550
8.50	2,535	10.60	3,750	19.00	10,040		
8.60	2,590	10.80	3,880	20.00	10,940		
8.70	2,645	11.00	4,010	21.00	11,850		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1901–1906. It is well defined.

Monthly discharge of Red River at Grand Forks, N. Dak., for 1906.

[Drainage area, 25,000 square miles.[a]]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January			[b] 1,750	108,000	0.070	0.08
February			[b] 1,590	88,300	.064	.07
March			[b] 1,890	116,000	.076	.09
April	27,600	7,000	[c] 19,800	1,180,000	.792	.88
May	9,620	6,980	8,220	505,000	.329	.38
June	7,880	5,200	6,060	361,000	.242	.27
July	6,530	3,210	4,560	280,000	.182	.21
August	3,910	2,700	3,180	196,000	.127	.15
September	2,920	2,180	2,470	147,000	.099	.11
October	2,540	1,920	2,200	135,000	.088	.10
November			[d] 2,150	128,000	.086	.10
December			[b] 1,630	100,000	.065	.07
The year			4,620	3,340,000	.185	2.51

[a] Revised since 1905 report.
[b] Estimated from gage heights and ice measurements.
[c] Discharge estimated April 1 to 8.
[d] Discharge November 20 to 30 estimated.

NOTE.—Values are rated as follows: January to March and December, fair; April and November, good; May to October, excellent.

OTTERTAIL RIVER NEAR FERGUS FALLS, MINN.

This station was established May 9, 1904. It is located at Three-mile Bridge, about 3½ miles northeast of Fergus Falls, Minn. The conditions at this station and the bench marks[a] are described in Water-Supply Paper No. 171, page 33, where are given also references to publications that contain data for previous years.

[a] During 1906 the gage was attached to the guard rail at station "20" on the lower side of the bridge. The bench mark is the center of the lowest bolt holding the vertical strap iron tie-rod against the face of the stone abutment on the right bank; it is about 3 feet above the lower angle of the abutment; elevation; 7.75 feet above gage datum.

Discharge measurements of Ottertail River near Fergus Falls, Minn., in 1905-6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
September 4	R. Richards	98	240	3.84	759
November 4	E. F. Chandler	98	202	3.49	539
1906.					
May 14	E. F. Chandler	93	225	3.89	786
June 25	do	92	264	4.30	1,010

Daily gage height, in feet, of Ottertail River near Fergus Falls, Minn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1				4.8	3.7	3.95	4.25	3.95	3.85	3.7	3.7	
2				4.6	3.75	4.0	4.25	3.95	3.85	3.7	3.7	
3				4.3	3.8	4.0	4.25	3.95	3.85	3.7	3.7	
4				4.0	3.8	4.0	4.25	3.95	3.85	3.7	3.7	
5				4.0	3.8	4.0	4.25	3.9	3.85	3.7	3.7	
6				3.5	3.8	4.1	4.25	3.9	3.85	3.7	3.65	
7				3.2	3.8	4.1	4.25	3.9	3.85	3.7	3.65	
8				3.2	3.8	4.15	4.25	3.85	3.85	3.7	3.65	
9				3.3	3.85	4.2	4.25	3.85	3.85	3.7	3.6	
10				3.3	3.85	4.2	4.2	3.8	3.85	3.7	3.6	
11	4.55			3.4	3.85	4.2	4.15	3.8	3.8	3.7	3.6	
12				3.4	3.85	4.2	4.15	3.8	3.8	3.7	3.6	
13				3.4	3.85	4.2	4.15	3.8	3.8	3.7	3.6	
14			4.7	3.4	3.9	4.2	4.15	3.8	3.8	3.7	3.6	
15				3.4	3.9	4.2	4.15	3.75	3.8	3.7	3.65	
16		4.6		3.4	3.9	4.2	4.15	3.75	3.8	3.7	3.65	
17				3.4	3.9	4.2	4.1	3.75	3.8	3.7	3.7	
18				3.4	3.9	4.2	4.1	3.75	3.8	3.7	3.9	
19				3.4	3.9	4.2	4.1	3.75	3.8	3.7	4.0	
20				3.4	3.9	4.2	4.0	3.7	3.8	3.7	4.5	
21				3.45	3.9	4.2	4.0	3.7	3.85	3.75	4.8	
22				3.45	3.9	4.2	4.0	3.7	3.8	3.8	4.8	4.65
23				3.45	3.9	4.2	4.0	3.75	3.8	3.8	4.8	
24				3.5	3.9	4.2	4.0	3.8	3.75	3.8	4.8	
25				3.5	3.95	4.25	4.0	3.85	3.75	3.75		
26	4.7			3.6	3.95	4.25	4.0	3.85	3.75	3.75		
27				3.65	3.95	4.25	4.0	3.85	3.75	3.7		
28				3.65	3.95	4.25	4.0	3.85	3.7	3.7		
29				3.65	3.95	4.25	4.0	3.85	3.7	3.7		
30				3.7	3.95	4.25	4.0	3.85	3.7	3.7		
31			4.8		3.95		3.95	3.85		3.7		

NOTE.—Ice conditions January 1 to April 6, also November 19 to December 31; gage heights were to water surface. The following comparative readings were made:

Comparative ice and water gage heights of Ottertail River near Fergus Falls, Minn.

Date.	Water surface.	Top of ice.	Thickness of ice.
January 11	4.55	4.65	1.3
January 26	4.7	4.8	1.6
February 16	4.6	4.7	1.7
March 14	4.7	4.8	1.6

Rating table for Ottertail River near Fergus Falls, Minn., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.20	402	3.50	552	3.80	726	4.10	921
3.30	449	3.60	607	3.90	789	4.20	987
3.40	499	3.70	665	4.00	855		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 12 discharge measurements made during 1904–1906. It is well defined between gage heights 2.8 feet and 3.8 feet.

Monthly discharge of Ottertail River near Fergus Falls, Minn., for 1906.

[Drainage area, 1,310 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	665	402	[a] 517	30,800	0.395	0.44
May	822	665	772	47,500	.589	.68
June	1,020	822	965	57,400	.737	.82
July	1,020	822	932	57,300	.711	.82
August	822	665	742	45,600	.566	.65
September	758	665	727	43,300	.555	.62
October	726	665	674	41,400	.515	.59
November (1–24)	855	607	[b] 686	32,600	.524	.47
The period				356,000		

[a] Discharge estimated April 1 to 6. [b] Discharge estimated November 20 to 24.

NOTE.—Values are rated as follows: April and November, good; May to October, excellent.

SHEYENNE RIVER NEAR HAGGART, N. DAK.

This station was established March 22, 1902. It is located near the station of Haggart, on the Northern Pacific Railway, 6 miles west of Fargo, N. Dak., at a private wagon bridge about one-fourth mile north of the railroad. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 35, where are given also references to publications that contain data for previous years.

Discharge measurements of Sheyenne River near Haggart, N. Dak., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 30	R. Richards	53	175	6.60	198
June 22	Chandler and Richards	46	154	4.70	173
July 11	R. Richards	47	147	4.60	156
July 29	Hanna and Chandler	44	134	4.42	146
August 22	R. Richards	54	216	6.01	288
November 18	E. F. Chandler	39	105	3.64	69
1906.					
April 14	E. F. Chandler	72	530	10.89	948
June 27	do	48	208	5.92	317
September 10	Grover and Chandler	39	105	3.45	68

Daily gage height, in feet, of Sheyenne River near Haggart, N. Dak., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	9.5	6.2	6.7	5.4	4.7	3.3	3.3	3.2	3.5
2	.....	.....	.....	9.65	6.2	6.5	5.5	4.7	3.3	3.3	3.2	.....
3	.....	.....	.....	8.7	6.2	6.4	5.5	4.6	3.3	3.3	3.2	.....
4	.....	.....	.....	7.2	6.1	6.2	5.4	4.6	3.3	3.3	3.2	.....
5	.....	.....	.....	7.1	6.1	6.2	5.3	4.5	3.2	3.2	3.2	.....
6	4.5	.....	.....	6.6	6.1	6.1	5.1	4.4	3.2	3.2	3.2	.....
7	.....	.....	.....	6.7	6.0	6.1	5.0	4.4	3.2	3.2	3.2	.....
8	.....	.....	.....	7.2	6.0	6.1	4.7	4.3	3.1	3.2	3.2	.....
9	.....	.....	.....	7.5	5.7	6.0	4.7	4.3	3.1	3.2	3.3	.....
10	.....	.....	.....	8.1	5.6	6.0	4.6	4.3	3.0	3.2	3.3	.....
11	.....	.....	.....	9.1	5.4	6.0	4.6	4.2	3.0	3.2	3.3	3.9
12	.....	.....	.....	9.7	5.3	5.7	4.6	4.2	3.0	3.2	3.3	.....
13	.....	.....	.....	10.3	5.2	5.7	4.5	4.2	3.0	3.2	3.3	.....
14	.....	.....	.....	10.6	5.0	5.6	4.5	4.1	3.0	3.2	3.3	.....
15	.....	.....	.....	11.5	4.7	5.5	4.5	4.1	3.1	3.2	3.3	.....
16	.....	5.6	5.6	11.7	5.1	5.5	4.5	4.0	3.1	3.2	3.4	.....
17	.....	.....	.....	11.6	5.2	5.5	4.4	4.0	3.2	3.2	3.4	.....
18	.....	.....	.....	11.2	5.5	5.6	4.3	3.7	3.2	3.2	3.4	.....
19	.....	.....	.....	10.7	6.0	5.7	4.3	3.7	3.3	3.2	3.4	.....
20	.....	.....	.....	10.5	6.2	5.7	4.2	3.6	3.3	3.2	3.4	.....
21	.....	.....	.....	10.2	6.1	5.6	4.2	3.6	3.4	3.2	3.4	.....
22	.....	.....	.....	9.7	5.7	5.5	4.2	3.6	3.4	3.2	3.4	.....
23	.....	.....	.....	9.2	5.6	5.5	4.1	3.6	3.5	3.2	3.4	.....
24	.....	.....	8.6	8.4	5.5	5.5	4.1	3.5	3.5	3.2	3.5	.....
25	.....	.....	9.2	7.6	5.7	5.5	4.1	3.5	3.5	3.2	3.5	.....
26	4.6	.....	8.7	7.2	6.0	5.6	4.1	3.5	3.4	3.2	3.5	.....
27	.....	.....	8.0	6.7	6.5	5.6	4.2	3.5	3.4	3.2	3.5	.....
28	.....	.....	7.6	6.6	7.2	5.5	4.4	3.4	3.4	3.2	3.5	.....
29	.....	.....	8.1	6.5	7.1	5.5	4.5	3.4	3.3	3.2	3.5	.....
30	.....	.....	8.4	6.2	7.1	5.4	4.6	3.4	3.3	3.2	3.5	.....
31	.....	.....	9.2	.....	7.0	.....	4.7	3.3	.....	3.2	.....	4.0

NOTE.—Ice conditions January 1 to April 3. Gage heights probably to water surface. Thickness of ice, 1.8 feet approximately. Ice conditions also November 20 to December 31.

Rating table for Sheyenne River near Haggart, N. Dak., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.00	32	4.30	131	5.60	269	7.80	554
3.10	38	4.40	140	5.70	281	8.00	580
3.20	44	4.50	149	5.80	294	8.20	606
3.30	51	4.60	159	5.90	307	8.40	632
3.40	58	4.70	169	6.00	320	8.60	658
3.50	65	4.80	179	6.20	346	8.80	684
3.60	72	4.90	189	6.40	372	9.00	710
3.70	80	5.00	200	6.60	398	10.00	840
3.80	88	5.10	211	6.80	424	11.00	970
3.90	96	5.20	222	7.00	450	12.00	1,100
4.00	104	5.30	233	7.20	476		
4.10	113	5.40	245	7.40	502		
4.20	122	5.50	257	7.60	528		

NOTE.—The above table is applicable only for open-channel conditions. It is based on the discharge measurements made during 1903–1906. It is fairly well defined.

Monthly discharge of Sheyenne River near Haggart, N. Dak., for 1905–6.

[Drainage area, 5,400 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec-ft. per sq. mile.	Depth in inches.
1905.[a]						
April (3–30)	385	113	201	11,200	0.037	0.04
May	814	96	326	20,000	.060	.07
June	333	169	206	12,300	.038	.04
July	398	88	177	10,900	.033	.04
August	684	104	303	18,600	.056	.06
September	159	80	120	7,140	.022	.02
October	104	65	79.7	4,900	.015	.02
November	96	.....	[b] 76.5	4,550	.014	.02
The period	.....	.....	.....	89,600	.....	.....
1906.						
April	1,060	346	682	40,600	0.126	0.14
May	476	169	311	19,100	.058	.07
June	411	245	295	17,600	.055	.06
July	257	113	162	9,960	.030	.03
August	169	51	104	6,400	.019	.02
September	65	32	47.5	2,830	.0088	.01
October	51	44	44.9	2,760	.0083	.01
November	58	44	[c] 52.6	3,130	.0097	.01
The period	.....	.....	.....	102,000	.....	.....

[a] For 1905 gage heights see Water-Supply Paper No. 171.
[b] Discharge estimated November 1 to 17, 1905.
[c] Discharge estimated November 24 to 30, 1906.

NOTE.—Values are rated as follows: June and July, 1905, excellent; remainder of 1905, good. It is impossible to determine the accuracy of the 1906 values which are subject to large errors, probably being much too low. This is due to the appointment of a new observer for 1906, who recorded the gage height as 0.4 foot less than the hydrographer on the days when measurements were made.

RED LAKE RIVER AT CROOKSTON, MINN.

The gaging station was established May 19, 1901. It is located at the bridge connecting Robert and St. Paul streets, Crookston, known as the "Sampson Addition" bridge. It is about one-sixth mile west of the Great Northern Railway station. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 37, where are given also references to publications that contain data for previous years.

Discharge measurements of Red Lake River at Crookston, Minn., 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq.ft.*	*Feet.*	*Sec.-ft.*
November 20	E. F. Chandler	176	628	5.90	1,680
1906.					
February 12	Chandler and Richards	174	471	6.75	[a] 984
April 16	E. F. Chandler	246	3,660	20.13	14,100
June 30	do	180	715	6.72	1,990
September 11	Grover and Chandler	173	405	4.80	968

[a] Ice measurement; gage height to undersurface of ice is 5.29 feet; ice thickness 0.7 foot to 2.7 feet. The discharge was about 45 per cent of the open-channel rating for gage height 6.75 feet.

Daily gage height, in feet, of Red Lake River at Crookston, Minn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.8	7.0	7.0	12.4	10.4	8.05	6.7	5.7	5.4	5.0	5.2	5.0
2	6.7	.....	.....	14.05	10.0	8.15	6.5	5.9	5.4	5.0	5.0	5.2
3	6.6	.....	.....	14.46	9.6	7.92	6.65	5.8	5.85	(5.25)	5.0	5.1
4	6.7	.....	6.85	15.77	9.5	7.8	6.45	5.5	5.55	5.5	4.5	5.3
5	6.7	.....	.....	15.3	9.5	(7.75)	6.55	5.6	5.3	5.25	4.2	5.0
6	6.8	7.1	7.0	12.39	9.6	7.72	6.5	5.65	5.2	5.2	4.4	5.4
7	6.8	.....	6.75	12.5	9.45	7.45	6.4	5.8	5.5	5.5	4.5	5.5
8	6.7	.....	6.8	10.3	9.25	7.4	6.2	5.35	5.25	5.05	4.5	5.6
9	6.8	.....	.....	11.15	9.1	7.4	6.15	5.6	5.5	4.9	4.6	5.5
10	6.9	7.2	.....	11.67	8.95	7.45	6.05	5.7	4.85	4.8	4.2	5.6
11	6.8	.....	7.1	12.1	8.9	7.55	6.2	5.65	5.05	5.15	4.3	5.6
12	6.7	.....	.....	13.18	8.8	7.3	6.15	5.5	5.1	4.75	4.3	5.6
13	6.7	.....	.....	14.41	8.7	7.2	6.1	5.55	5.35	5.0	4.2	5.5
14	6.7	.....	.....	19.78	8.6	7.08	6.05	5.7	4.85	4.6	4.1	5.4
15	.....	.....	6.9	20.97	8.7	7.0	6.0	5.9	5.05	5.1	4.5	5.6
16	.....	.....	.....	19.81	8.6	6.8	6.0	6.6	5.35	5.05	4.2	5.5
17	.....	6.5	.....	18.45	8.55	6.6	5.9	6.0	5.5	4.95	4.2	5.6
18	.....	.....	6.8	16.92	8.9	6.45	5.9	6.15	4.5	4.6	4.2	5.5
19	.....	.....	.....	15.6	8.7	6.85	5.9	5.9	5.0	4.15	4.2	5.6
20	.....	6.55	7.25	14.6	8.5	6.65	5.9	5.8	5.4	4.5	4.2	5.6
21	.....	.....	.....	13.75	8.25	6.4	6.0	6.0	5.25	4.7	4.9	5.5
22	.....	.....	7.05	13.0	8.05	6.65	6.0	5.7	5.05	4.4	4.7	5.6
23	.....	.....	7.15	12.4	7.85	6.65	5.9	5.25	4.9	4.5	4.3	5.6
24	.....	6.5	7.2	12.1	7.75	6.65	5.85	5.55	5.35	4.5	4.3	5.6
25	7.1	.....	6.95	11.9	7.85	6.6	5.9	5.55	5.5	4.6	4.7	5.6
26	.....	.....	7.05	11.5	7.72	6.55	5.9	5.5	5.55	4.3	4.3	5.6
27	.....	6.8	7.1	11.2	7.55	6.68	5.8	5.6	5.5	4.2	4.9	5.6
28	7.2	.....	7.15	11.0	7.5	6.6	5.75	5.75	5.25	4.4	5.0	5.6
29	.....	.....	9.62	10.9	7.7	6.65	5.8	5.4	5.0	4.4	4.9	5.6
30	.....	.....	11.1	.....	7.7	6.62	5.8	5.3	5.35	4.5	5.0	5.6
31	7.4	.....	11.45	.....	7.8	.....	5.65	5.5	.....	4.7	.....	5.6

NOTE.—Ice conditions January 1 to April 4, there being a narrow, open channel from January 1 to 24. Gage readings to water surface January 1 to 14, and to top of ice during remainder of ice period. Ice condition also during December, except for narrow channel during part of the month.

Rating table for Red Lake River at Crookston, Minn., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.10	615	5.20	1,220	6.30	1,950	7.80	3,095
4.20	660	5.30	1,280	6.40	2,020	8.00	3,255
4.30	710	5.40	1,340	6.50	2,095	8.20	3,415
4.40	760	5.50	1,400	6.60	2,170	8.40	3,575
4.50	815	5.60	1,465	6.70	2,245	8.60	3,735
4.60	870	5.70	1,530	6.80	2,325	8.80	3,895
4.70	925	5.80	1,600	6.90	2,395	9.00	4,055
4.80	980	5.90	1,670	7.00	2,470	9.20	4,225
4.90	1,040	6.00	1,740	7.20	2,620	9.40	4,395
5.00	1,100	6.10	1,810	7.40	2,775		
5.10	1,160	6.20	1,880	7.60	2,935		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 24 discharge measurements made during 1902–1906. It is well defined. Above gage height 9 feet the rating curve is a tangent, the difference being 85 per tenth.

Monthly discharge of Red Lake River at Crookston, Minn., for 1906.

[Drainage area, 5,520 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January [a]			1,500	92,200	0.272	0.31
February [a]			1,020	56,600	.185	.19
March [a]			1,500	92,200	.272	.31
April [b]	14,200	5,880	8,090	481,000	1.47	1.64
May	5,240	2,860	3,780	232,000	.685	.79
June	3,380	2,020	2,540	151,000	.460	.51
July	2,240	1,500	1,800	111,000	.326	.38
August	1,840	1,250	1,520	93,500	.275	.32
September	1,640	815	1,260	75,000	.228	.25
October	1,400	638	983	60,400	.178	.21
November	1,220	660	836	49,700	.151	.17
The period				1,490,000		

[a] Estimated from gage heights and one ice measurement.
[b] Discharge, April 1 to 4, estimated.

NOTE.—Values are rated as follows: January and March, approximate; February, fair; April to October, excellent; November good.

PEMBINA RIVER NEAR NECHE, N. DAK.

The gaging station was established April 29, 1903. It is located at the Great Northern Railway bridge, two-thirds of a mile north of the railroad station at Neche, N. Dak. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 40, where are given also references to publications that contain data for previous years.

Discharge measurements of Pembina River near Neche, N. Dak., in 1904 and 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1904.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 18	R. Richards	85	634	11.85	[a] 1,230
April 26	do	92	1,490	18.12	3,200
May 23	do	96	909	13.28	2,230
June 8	E. C. Murphy	86	837	12.04	1,780
July 9	R. Richards	79	488	8.51	971
August 16	do	72	299	5.70	363
October 17	L. L. Wilcox	70	274	5.22	249
1906.					
April 23	R. Richards	70	220	4.47	288
June 11	E. F. Chandler	70	246	4.88	372
August 15	do	66	157	3.67	140
October 22	do	66	178	3.67	132

[a] Discharge affected by ice jam below station.

Daily gage height, in feet, of Pembina River near Neche, N. Dak., for 1906.[a]

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	4.0	4.2	4.1	4.4	3.5	3.65	3.7	3.65
2	7.5	4.15	4.3	4.3	3.5	3.7	3.7	3.65
3	8.5	4.15	4.35	4.2	3.5	3.7	3.7	3.65
4	9.0	4.15	4.35	4.1	3.5	3.7	3.75	3.65
5	8.5	4.1	4.3	4.2	3.5	3.65	3.75	3.65
6	8.0	4.1	4.3	4.3	3.5	3.65	3.75	3.6
7	7.5	4.1	4.3	4.4	3.5	3.65	3.75	3.5
8	6.5	4.05	4.4	4.35	3.5	3.65	3.75	3.5
9	6.0	4.05	4.45	4.3	3.5	3.65	3.75	3.5
10	5.5	4.0	4.6	4.2	3.6	3.65	3.75	3.5

[a] 1904 gage heights published in Water-Supply Paper No. 130.

Daily gage height, in feet, of Pembina River near Neche, N. Dak., for 1906—Continued.

Days.	Apr.	May.	June.	July.	Aug	Sept	Oct	Nov
11	5.0	3.95	4.65	4.15	3.7	3.65	3.7	[illegible]
12	4.9	3.95	4.6	4.1	3.7	3.65	3.7	3.65
13	4.8	3.9	4.5	3.9	3.7	3.65	3.7	3.65
14	4.8	3.9	4.4	3.8	3.7	3.8	3.75	3.1
15	4.85	3.9	4.3	3.8	3.65	3.8	3.75	3.1
16	4.8	3.9	4.2	.....	3.65	3.75	3.7	[illegible]
17	4.8	3.9	4.1	3.7	3.65	3.75	3.7	[illegible]
18	4.75	3.9	4.1	3.7	3.65	3.75	3.7	[illegible]
19	4.7	3.95	4.45	3.65	3.65	3.7	3.7	[illegible]
20	4.6	3.95	4.45	3.6	3.6	3.7	3.7	
21	4.55	4.1	4.75	3.6	3.6	3.7	3.7	
22	4.5	4.0	4.75	3.6	3.6	3.7	3.7	
23	4.45	4.0	4.6	3.55	3.6	3.8	3.7	
24	4.4	4.0	4.5	3.5	3.6	3.85	3.7	
25	4.4	3.95	4.0	3.55	3.65	3.85	3.7	
26	4.35	3.95	4.0	3.5	3.65	3.85	3.7	
27	4.3	3.9	4.5	3.5	3.65	3.85	3.65	
28	4.25	3.9	4.5	3.5	3.65	3.8	3.65	
29	4.2	3.9	4.75	3.55	3.65	3.8	3.65	
30	4.2	3.9	4.6	3.5	3.65	3.75	3.65	
31	.....	4.0	.....	3.5	3.65	.....	3.65	

NOTE.—Ice conditions January 1 to April 7; also November 18 to December 31.

Rating table for Pembina River near Neche, N. Dak.

JANUARY 1 TO DECEMBER 31, 1904.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.50	131	6.10	442	7.70	794	10.60	1,448
4.60	147	6.20	464	7.80	816	10.80	1,494
4.70	164	6.30	486	7.90	838	11.00	1,540
4.80	181	4.40	508	8.00	860	12.00	1,770
4.90	199	6.50	530	8.20	904	13.00	2,000
5.00	217	6.60	552	8.40	948	14.00	2,230
5.10	236	7.70	574	8.60	992	15.00	2,460
5.20	255	6.80	596	8.80	1,036	16.00	2,690
5.30	275	6.90	618	9.00	1,080	17.00	2,930
5.40	295	7.00	640	9.20	1,126	18.00	3,170
5.50	315	7.10	662	9.40	1,172	19.00	3,410
5.60	336	7.20	684	9.60	1,218	20.00	3,650
5.70	357	7.30	706	9.80	1,264	21.00	3,890
5.80	378	7.40	728	10.00	1,310		
5.90	399	7.50	750	10.20	1,356		
6.00	420	7.60	772	10.40	1,402		

JANUARY 1 TO DECEMBER 31, 1906.[b]

3.00	79	4.20	231	5.40	470	7.00	800
3.10	85	4.30	250	5.50	490	7.20	812
3.20	92	4.40	270	5.60	510	7.40	881
3.30	100	4.50	290	5.70	530	7.60	926
3.40	109	4.60	310	5.80	550	7.80	968
3.50	119	4.70	330	5.90	570	8.00	1,010
3.60	130	4.80	350	6.00	590	8.20	1,052
3.70	143	4.90	370	6.20	632	8.40	1,094
3.80	158	5.00	390	6.40	674	8.60	1,136
3.90	175	5.10	410	6.60	716	8.80	1,178
4.00	193	5.20	430	6.80	758	9.00	1,220
4.10	212	5.30	450				

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904. It is well defined between gage heights 5.0 feet and 18.0 feet.

[b] This table is applicable only for open-channel conditions. It is based on 9 discharge measurements made during 1905-6. It is well defined between gage heights 3.2 feet and 6.0 feet.

Monthly discharge of Pembina River near Neche, N. Dak., for 1904–1906.[a]

[Drainage area, 2,940 square miles.[b]]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
1904.[c]						
April (8–30)[d]	3,580	217	1,920	87,600	0.653	0.56
May	3,870	1,420	2,640	162,000	.898	1.04
June	2,530	926	1,690	101,000	.575	.64
July	2,690	399	839	51,600	.285	.33
August	420	315	385	23,700	.131	.15
September	315	236	302	18,000	.103	.11
October	275	217	235	14,400	.080	.09
November (1–26)	217	131	183	9,440	.062	.06
The period				468,000		
1906.[e]						
April[f]	1,220	193	479	28,500	.163	.18
May	231	175	193	11,900	.066	.08
June	340	193	271	16,100	.092	.10
July	270	119	175	10,800	.060	.07
August	143	119	131	8,060	.045	.05
September	166	136	147	8,750	.050	.06
October	150	136	144	8,850	.049	.06
November (1–19)	136	82	111	4,180	.038	.03
The period				97,100		

[a] Monthly discharge values for 1905 published in Water-Supply Paper No. 171. Some are subject to considerable error, owing to doubtful gage heights.
[b] Revised since 1905 report.
[c] Values for 1904 are rated as follows: April, fair; May to August, excellent; September to November, good. Gage heights for September and October are doubtful; otherwise values for these months could be classed as excellent.
[d] Discharge estimated for ice period April 8 to 20.
[e] Values for 1906 are probably good. Some months might be classed as excellent, but the observer's records for June at least do not appear to be good.
[f] Discharge not corrected for ice conditions April 1 to 7.

MISCELLANEOUS MEASUREMENTS IN RED RIVER DRAINAGE BASIN.

The following miscellaneous measurements were made in 1906 at the mouth of Red Lake River at East Grand Forks, Minn:

March 23: Area of section, 627 square feet; discharge, 853 second-feet; ice 2 feet thick.

August 11: Area of section, 1,000 square feet; discharge, 1,150 second-feet.

MOUSE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The Mouse (or Souris) River rises in the southeastern part of the Province of Assiniboia, Canada, and flows southeastward to the western part of McHenry County, N. Dak., thence northeastward for about 30 miles to Towner, N. Dak., where it makes another turn to the north and northwest, which carries it back into Canada, to empty into Assiniboine River, a tributary of Red River. Its drainage basin, which is limited on the southwest by the Missouri Coteau and on the northeast by the Turtle Mountains, is relatively large, but its flow is small. The region through which it flows is generally gently rolling,

except in the immediate vicinity of the stream, where the hills are steep and high. The chief tributary of the Mouse above Minot is Des Lacs River.

The data collected in this basin are valuable for irrigat on purposes.

MOUSE RIVER NEAR FOXHOLM, N. DAK.

This station was established June 22, 1904, and was discontinued July 31, 1906. It is located at the highway bridge 3½ miles northeast of Foxholm, N. Dak., a station on the Minneapol's, St. Paul and Sault Ste. Marie Railway. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 42, where are given also references to publications that contain data for previous years.

Discharge measurements of Mouse River near Foxholm, N. Dak., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905. September 16	E. F. Chandler	31	7.4	1.50	[a] 4.9
1906. April 24	E. F. Chandler	61	203	2.92	215
June 28	do	65	241	3.40	310

[a] Wading section

Daily gage height, in feet, of Mouse River near Foxholm, N. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Day.	Mar.	Apr.	May.	June.	July.
1		3.4	2.5	2.7	3.3	17		3.9	2.3	4.3	2.7
2		4.0	2.5	2.7	3.3	18		3.5	2.2	4.2	2.7
3		5.0	2.5	2.6	3.3	19		3.4	2.1	4.0	2.6
4		6.1	2.5	2.5	3.2	20		3.0	2.2	3.9	2.5
5		7.8	2.4	2.5	3.3	21		3.2	2.2	3.9	2.5
6		8.0	2.4	2.8	3.4	22		3.0	2.2	3.9	2.5
7		8.6	2.4	3.0	3.45	23		3.0	2.2	3.9	2.4
8		8.9	2.4	3.0	3.4	24		2.9	2.2	3.9	2.4
9		8.0	2.5	3.0	3.3	25		3.0	2.2	3.8	2.3
10		7.8	2.5	3.3	3.3	26	3.1	2.9	2.2	3.7	2.3
11		6.8	2.4	3.6	3.2	27		2.8	2.2	3.5	2.2
12		6.5	2.4	3.9	3.1	28		2.7	2.2	3.4	2.2
13		5.6	2.4	4.7	2.9	29		2.6	2.2	3.3	2.1
14		4.8	2.4	5.0	2.9	30		2.6	2.3	3.2	2.1
15		4.0	2.5	5.0	2.8	31	3.9		2.5		2.0
16		3.9	2.3	4.7	2.7						

NOTE.—Ice conditions January 1 to March 31.

MOUSE RIVER AT MINOT, N. DAK.

This station was established May 5, 1903. It is located at the footbridge 150 feet northwest of the Great Northern Railway roundhouse at Minot, N. Dak. The gage was read during 1906 by James

Cavanaugh. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 45, where are given also references to publications that contain data for previous years.

Discharge measurements of Mouse River at Minot, N. Dak., in 1904–1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1904.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 22	E. F. Chandler	88	400	6.69	698
June 24	do	87	373	6.32	577
July 13	R. Richards	83	291	5.16	279
July 14	do	83	299	5.29	312
August 12	do	77	220	4.40	102
September 18	E. F. Chandler	74	220	4.30	88
1905.					
March 27	Chandler and Richards	76	227	4.40	114
April 27	E. F. Chandler	70	195	4.03	44
May 24	do	77	223	4.56	139
May 24	do	54	89	4.45	[a] 122
August 18	R. Richards	48	58	4.01	[a] 36
September 17	E. F. Chandler	40	23	3.86	[a] 14
1906.					
April 23	E. F. Chandler	80	279	5.19	300
May 29	do	76	218	4.42	112
June 29	do	82	297	5.33	343
September 6	do	50	57	4.00	[a] 30
September 6	do	38	39	4.00	[a] 31

[a] Wading section.

Daily gage height, in feet, of Mouse River at Minot, N. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	5.0	4.9	5.4	5.2	4.5	4.0	3.8	3.9
2	.....	5.2	4.9	5.5	5.2	4.4	4.0	3.8	3.9
3	.....	5.4	4.8	5.5	5.2	4.4	4.0	3.8	3.9
4	.....	5.0	4.8	5.3	5.2	4.4	4.0	3.8	3.9
5	.....	5.2	4.8	5.2	5.1	4.4	4.0	3.8	3.9
6	.....	5.4	4.8	5.9	5.1	4.4	4.0	3.8	3.9
7	.....	5.7	4.8	5.9	5.1	4.3	4.0	3.9	3.9
8	.....	6.5	4.8	5.8	5.1	4.3	4.0	3.9	3.9
9	.....	8.0	4.7	5.8	5.1	4.3	4.0	3.9	3.9
10	.....	9.4	4.7	5.8	5.0	4.3	4.0	3.9	3.9
11	.....	9.2	4.7	5.8	5.0	4.3	4.0	3.9	3.9
12	.....	8.4	4.7	5.9	5.0	4.2	4.0	3.9	3.9
13	.....	7.3	4.7	5.9	5.0	4.2	4.0	3.9	3.9
14	.....	5.7	4.6	6.0	5.0	4.2	4.0	3.9	3.9
15	.....	5.7	4.6	6.1	5.0	4.1	4.0	3.9	3.9
16	.....	5.7	4.6	6.1	4.9	4.1	4.0	3.9	3.9
17	.....	5.7	4.6	6.0	4.9	4.1	4.0	3.9	3.9
18	.....	5.6	4.6	5.9	4.8	4.1	4.0	3.9	3.9
19	.....	5.6	4.6	5.8	4.7	4.1	4.0	3.9	.....
20	.....	5.4	4.6	5.8	4.7	4.1	3.9	3.9	.....
21	.....	5.4	4.5	5.8	4.6	4.0	3.9	3.9	.....
22	.....	5.4	4.5	5.7	4.8	4.0	3.9	3.9	.....
23	.....	5.3	4.5	5.6	4.8	4.0	3.9	3.9	.....
24	.....	5.2	4.4	5.6	4.7	4.0	3.9	3.9	.....
25	.....	5.2	4.4	5.5	4.7	4.0	3.9	3.9	.....
26	.....	5.1	4.4	5.5	4.6	4.0	3.9	3.9	.....
27	.....	5.1	4.4	5.4	4.6	4.0	3.9	3.9	.....
28	.....	5.0	4.4	5.4	4.6	4.0	3.9	3.9	.....
29	4.0	5.0	4.4	5.4	4.6	4.0	3.9	3.9	.....
30	4.4	5.0	4.6	5.4	4.5	4.0	3.9	3.9	.....
31	4.8	.....	4.8	.....	4.5	4.0	.....	3.9	.....

NOTE.—Ice conditions January 1 to April 5; also November 18 to December 31.

Rating tables for Mouse River at Minot, N. Dak.

JANUARY 1, 1904, TO DECEMBER 31, 1905.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.80	10	4.00	33	4.20	68	4.40	108
3.90	20	4.10	50	4.30	87	4.50	130

JANUARY 1 TO DECEMBER 31, 1906.[b]

3.90	18	5.00	240	6.10	499	7.40	820
4.00	31	5.10	263	6.20	523	7.60	870
4.10	46	5.20	286	6.30	547	7.80	920
4.20	66	5.30	309	6.40	571	8.00	970
4.30	87	5.40	332	6.50	595	8.20	1,020
4.40	108	5.50	355	6.60	620	8.40	1,070
4.50	130	5.60	379	6.70	645	8.60	1,120
4.60	152	5.70	403	6.80	670	8.80	1,170
4.79	174	5.80	427	6.90	695	9.00	1,220
4.80	196	5.90	451	7.00	720	9.20	1,270
4.90	218	6.00	475	7.20	770	9.40	1,320

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904 and 1905. Prior to about June 20, 1904, the conditions of flow were not the same as they were after that date and any rating would be very uncertain. It is well defined between gage heights 3.85 feet and 6 feet. Above gage height 4.5 feet the table for 1906 should be used.

[b] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906. It is not well defined above 6 feet, but is well defined below this point.

Monthly discharge of Mouse River at Minot, N. Dak., for 1904 to 1906.

[Drainage area, 8,400 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
1904.[a]						
July	427	152	258	15,900	0.031	0.04
August	152	108	114	7,010	.014	.02
September	108	68	81.7	4,860	.0097	.01
October	87	68	71.8	4,410	.0085	.01
November 1–25	87	50	64.3	3,190	.0077	.01
The period				35,400		
1905.[b]						
March 5–31	108	78	97.6	5,230	0.012	0.01
April	78	33	61.2	3,640	.0073	.01
May	130	33	64.1	3,940	.0076	.01
June	119	68	98.6	5,870	.012	.01
July	108	59	81.3	5,000	.0097	.01
August	108	33	68.4	4,210	.0081	.01
September	87	10	30.3	1,800	.0036	.004
October	20	10	15.5	953	.0018	.002
November 1–28	33	20	24.6	1,370	.0029	.003
The period				32,000		
1906.[c]						
April	1,320	240	454	27,000	0.054	0.06
May	218	108	159	9,780	.019	.02
June	499	286	401	23,900	.048	.05
July	286	130	214	13,200	.025	.03
August	130	31	61.9	3,810	.0074	.01
September	31	18	26.2	1,560	.0031	.003
October	18	8	16.1	990	.0019	.002
November 1–18	18	18	18.0	643	.0021	.001
The period				80,900		

[a] Gage heights for 1904 have been published in Water-Supply Paper No. 130. Discharge values for 1904 are excellent. During the spring flood the maximum discharge was estimated to be 12,000 second-feet. Discharge values for stages greater than about 10 feet are very uncertain, owing to the collection of débris below the section causing back water.

[b] Estimates of monthly discharge for 1905 have been revised; gage heights for 1905 are published in Water-Supply Paper No. 171. Discharge values for 1905 are rated as follows: March to August, excellent; September to November, fair.

[c] Discharge values for 1906 are rated as follows: April and September, good; May to August, excellent; October and November, fair.

DES LACS RIVER AT FOXHOLM, N. DAK.

This station was established June 23, 1904, and was discontinued July 31, 1906. It is located at the highway bridge at Foxholm, N. Dak., a station of the Minneapolis, St. Paul and Sault Ste. Marie Railway. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 47, where are given also references to publications that contain data for previous years.

Discharge measurements of Des Lacs River at Foxholm, N. Dak., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
September 16	E. F. Chandler	.....	3	1.96	[a] 1.6
1906.					
April 24	E. F. Chandler	17	8.3	2.36	[a] 6.6
Do	do	17	22	2.36	6.6
June 28	do	16	6.9	2.31	[a] 5.9

[a] Wading section.

Daily gage height, in feet, of Des Lacs River at Foxholm, N. Dak., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	2.0	.....	.....	8.4	2.35	3.4	2.0
2	.....	.....	.....	8.0	2.35	3.0	2.0
3	.....	2.0	2.4	7.9	2.3	3.0	1.9
4	.....	.....	.....	7.6	2.3	3.0	1.9
5	.....	.....	.....	5.0	2.3	3.7	1.9
6	.....	.....	.....	4.7	2.3	3.8	1.9
7	.....	.....	.....	3.7	2.25	3.8	1.9
8	.....	.....	.....	3.7	2.25	3.8	1.9
9	.....	.....	.....	3.6	2.0	3.7	1.8
10	.....	.....	3.0	3.55	2.0	3.7	1.8
11	.....	.....	.....	3.4	2.0	3.65	1.8
12	.....	.....	.....	3.2	2.0	3.5	1.8
13	.....	.....	.....	3.0	2.0	3.3	1.8
14	.....	.....	.....	2.8	2.1	3.0	1.8
15	.....	.....	.....	2.7	2.2	2.8	1.8
16	.....	.....	.....	2.65	2.2	2.8	1.8
17	.....	.....	.....	2.6	2.25	2.8	1.8
18	.....	.....	.....	2.6	2.25	2.8	1.8
19	.....	.....	.....	2.5	2.25	2.7	1.8
20	.....	.....	.....	2.45	2.25	2.7	1.8
21	.....	.....	.....	2.45	2.3	2.6	1.8
22	.....	.....	.....	2.4	3.0	2.6	1.8
23	.....	.....	.....	2.4	3.2	2.6	1.8
24	.....	2.0	.....	2.4	3.3	2.5	1.8
25	.....	.....	3.0	2.35	3.5	2.4	1.8
26	.....	.....	3.0	2.35	3.6	2.4	1.8
27	2.0	.....	4.0	2.35	3.6	2.3	1.8
28	.....	.....	5.3	2.4	3.7	2.0	1.8
29	.....	.....	6.0	2.4	3.7	2.0	1.8
30	.....	.....	7.0	2.35	3.7	2.0	1.8
31	.....	.....	7.5	.....	3.5	.....	1.8

NOTE.—Ice conditions January 1 to March 24; gage heights were probably to water surface in hole in ice; average thickness of ice, 1.1 feet.

Rating table for Des Lacs River at Foxholm, N. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.80	0.9	2.60	11	3.40	29	5.00	92
1.90	1.5	2.70	13	3.50	32	5.50	119
2.00	2.4	2.80	15	3.60	35	6.00	149
2.10	3.6	2.90	17	3.70	38	6.50	183
2.20	4.9	3.00	19	3.80	41	7.00	222
2.30	6.3	3.10	21	3.90	44	7.50	265
2.40	7.8	3.20	23	4.00	47	8.00	313
2.50	9.3	3.30	26	4.50	68		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906. It is fairly well defined up to gage height 4 feet; above that point the table is not well defined.

Monthly discharge of Des Lacs River at Foxholm, N. Dak., for 1906.

[Drainage area 615 square miles.]

Month	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March (25–31)	265	19	118	1,640	0.192	0.05
April	355	7.0	59.6	3,550	.097	.11
May	38	2.4	13.6	836	.022	.03
June	41	2.4	19.8	1,180	.032	.04
July	2.4	0.9	1.1	68	.0018	.002
The period				7,270		

NOTE.—Values are rated as follows: March and July, fair; April to June, good.

UPPER MISSISSIPPI RIVER DRAINAGE.

GENERAL FEATURES.

The sources of Mississippi River proper lie between latitudes 47° and 48° north, almost exactly in the center of the continent on an east-west line; its mouth is in latitude 29° north.

The basin, which is very irregular in outline, can best be described as an oblong with the major axis, 1,700 miles in length, running southeastward from the northwestern part of Montana, through North Dakota, Nebraska, Missouri, and Tennessee, into the northwestern corner of Alabama. On each side of this line the basin spreads out from 300 to 500 miles, while on the east there is a large protuberance from the general outline extending to the Allegheny Mountains. The eastern outline conforms roughly to that of the Atlantic coast, the mean distance between them being about 250 miles; the eastern and western outlines are determined by the two great mountain systems of the continent, the Appalachian and the Cordilleran. The total area drained is 1,240,000 square miles. It includes wholly or in part thirty States, besides a small area in the Dominion of Canada.

Topographically the country included within the Mississippi basin presents all varieties of form—mountain, prairie, arid plain, and alluvial bottom land teeming with vegetation, all are represented.

The drainage system may be divided into four grand sections, in the following order of size: (1) The Missouri basin, (2) the basins of Arkansas and Red rivers, (3) the Ohio basin, and (4) the basin of the upper Mississippi. The area last named, which is considered in this report, extends from the source of the river to the mouth of the Missouri; below that the stream is called the lower Mississippi.

In the northern part of Minnesota, 2,555 miles from the Gulf of Mexico, is a low plain consisting of sandy ridges of glacial origin, known as the Hauteur des Terres. It is a region of innumerable lakes, from one of the smallest of which, Lake Hernando de Soto, springs the great river. Lake Hernando de Soto is drained by a small stream flowing into Itasca Lake, which was for many years considered the source of the river. The length of Itasca Lake is about 4 miles and its breadth nowhere exceeds one-half mile. Its outlet is from 10 to 12 feet wide and from 12 to 18 inches deep.

From its utmost source to the falls of Pokegama the river flows through a drift-covered region in a valley, which is in some places narrow, in others broad and savanna-like, with many rapids in the narrower and with gentle or sluggish currents in the broader portions. In this part of its course it drains a number of lakes, among which Bemidji, Cass, Winnibigoshish, and Leech lakes are the most important. The total fall from the head of the stream to the mouth of Leech Lake River, which is nearly as large as the main stream, is about 420 feet. The first rock in place is at Pokegama Falls, and thence to the mouth of Crow Wing River, which enters from the west, the average width of the stream is 300 feet; the valley is less winding, and the current is good, with many rapids of small extent. The mouth of Crow Wing River is only 75 miles in a straight line from Lake Itasca, but the distance along the river course is 450 miles.

Below the mouth of the Crow Wing the river flows in a general southerly direction for about 475 miles. Within this stretch are several rapids, the chief being Little Falls and Sauk Rapids, and many timbered islands. The banks are abrupt, of clay or sandy loam, and lead to meadows that stand 60 feet above the river. At the falls of St. Anthony the river pitches down a vertical fall and rapid amounting to 75 feet in half a mile, and in so doing leaves the prairie and clay banks for a channel that lies between rocky bluffs of limestone and sandstone, which continue for many miles down the river, gradually increasing to a height of 500 feet as the bed sinks below the general prairie level. The sides of the bluffs are not vertical, bare surfaces of rock, but are composed of easily eroded stone and drift, which form well-wooded or grassy slopes.

Minnesota River, formerly called St. Peters River, enters the Mississippi about 10 miles below St. Anthony Falls, and below its mouth the breadth of the main stream averages 1,000 feet. From this point to the mouth of the Missouri the general characteristics of the river are the same—a broad placid stream with innumerable islands, the entire width of the valley averaging 1 mile. In many places, especially where tributaries enter, there are fertile flats between the river and the bluffs. Fifty-five miles below the mouth of the Minnesota is Lake Pepin, an expansion of the river apparently caused by the immense quantities of sand brought down by the Chippewa.

At two places exceptions occur to the otherwise placid character of the river. At Rock Island, Ill., 384 miles from St. Paul, there are rapids by which the river falls 20.4 feet in 12 miles, and at Keokuk, Iowa, 509 miles from St. Paul, is the foot of the Des Moines Rapids, where in a distance of 11 miles the river falls 21.85 feet.

The large tributaries below the Minnesota are the St. Croix, Chippewa, Wisconsin, Rock, and Illinois from the east and the Iowa and Des Moines from the west.

MISSISSIPPI RIVER PROPER.

MISSISSIPPI RIVER NEAR SAUK RAPIDS, MINN.

This station was established April 23, 1903, and was discontinued March 31, 1906, owing to the construction of a dam 2 miles below. It is located about 1½ miles south of Watab station, on the Northern Pacific Railway, about 5 miles north of Sauk Rapids and 7 miles north of St. Cloud. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 51, where are given also references to publications that contain data for previous years.

Discharge measurements of Mississippi River near Sauk Rapids, Minn., in 1903–1905.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1903.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 4	W. R. Hoag	580	4,080	13.22	7,910
September 9	E. C. Murphy	615	3,350	11.85	5,020
Do	Murphy and Stockman	615	3,340	11.85	5,040
October 17	L. R. Stockman	631	5,680	15.60	17,400
1904.					
January 5	E. Johnson jr	515	2,200	[a] 11.55	2,470
April 20	E. F. Chandler	585	4,170	14.26	12,300
July 1	do	577	3,790	13.31	8,020
July 25	R. Richards	557	2,680	11.38	4,740
August 22	do	572	3,400	12.76	[b] 4,340
September 8	do	561	2,860	11.77	[c] 4,800
October 15	E. F. Chandler	578	3,820	13.75	9,350
1905.					
January 3	R. Richards	560	1,810	[d] 11.29	2,620
April 5	do	582	3,890	13.60	8,520
December 26	do	580	3,690	12.88	6,800

[a] Ice 1.7 feet thick, and anchor ice. Gage height to bottom of ice, 10.20 feet.
[b] Log jam 600 feet below.
[c] Partial log jam 600 feet below.
[d] Ice 1.5 feet thick. Gage height to bottom of ice, 9.9 feet.

Daily gage height, in feet, of Mississippi River near Sauk Rapids, Minn., for 1906.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
3		12.95	13.25	20	12.95		
8	12.9			24		13.35	12.75
10		12.95	13.15	25		13.35	
14	12.95			27	12.95		
17		13.0	12.85	31			13.5
18		13.0					

NOTE.—No ice notes given by observer; ice conditions not known. The river, however, was known to be open December 26, 1905.

Rating table for Mississippi River near Sauk Rapids, Minn., for 1903–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
10.80	3,480	12.10	5,450	13.40	8,310	15.40	16,370
10.90	3,610	12.20	5,640	13.50	8,590	15.60	17,440
11.00	3,740	12.30	5,830	13.60	8,880	15.80	18,550
11.10	3,880	12.40	6,020	13.70	9,180	16.00	19,700
11.20	4,020	12.50	6,220	13.80	9,490	16.20	20,890
11.30	4,160	12.60	6,420	13.90	9,810	16.40	22,120
11.40	4,300	12.70	6,630	14.00	10,150	16.60	23,390
11.50	4,450	12.80	6,840	14.20	10,870	16.80	24,700
11.60	4,600	12.90	7,060	14.40	11,660	17.00	26,050
11.70	4,760	13.00	7,290	14.60	12,510	18.00	33,200
11.80	4,920	13.10	7,530	14.80	13,400	19.00	40,990
11.90	5,090	13.20	7,780	15.00	14,350	20.00	49,290
12.00	5,270	13.30	8,040	15.20	15,340		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1905. It is well defined between gage heights 11.5 feet and 16.0 feet.

Monthly discharge of Mississippi River near Sauk Rapids, Minn., for 1903–1905.[a]

[Drainage area, 12,400 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1903.[b]					
May 3–31	21,200	10,200	13,600	1.10	1.19
June	9,650	4,300	5,750	.464	.52
July	8,450	4,230	6,090	.491	.57
August	7,830	4,450	6,000	.484	.56
September	18,300	4,520	10,300	.831	.93
October	27,100	7,290	16,000	1.29	1.49
November 1–14; 27–30[c]	9,840	5,360	6,720	.542	.36
December			3,740	.302	.35
1904.[d]					
January			2,340	.189	.22
February			2,070	.167	.18
March			2,620	.211	.24
April 11–30[e]	19,100	10,300	12,600	1.02	.76
May	12,500	7,660	10,400	.839	.97
June	13,200	5,540	8,700	.702	.78
July	8,040	3,950	5,910	.477	.55

[a] It is possible that log jams below this station may have affected results over relatively short periods. Ice estimates are based on the observer's notes on ice statements and on two measurements made under ice conditions.

[b] Gage heights for 1903 have been published in Water-Supply Paper No. 98. Discharge values are rated as follows: May to July, good; August to November, excellent; remainder of the year, approximate. Ice conditions December 1 to 31.

[c] No gage-height records November 15 to 26.

[d] Gage heights for 1904 have been published in Water-Supply Paper No. 128. Discharge values for 1904 are rated as follows: April to November, excellent; remainder of the year, approximate. Ice conditions as follows: January 1 to April 10, December 1 to December 31.

[e] Ice gorge April 1 to 10.

Monthly discharge of Mississippi River near Sauk Rapids, Minn. for 1904–1905—Concluded.

Month.	Discharge in second-feet.			Runoff.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. miles.	Depth in inches.
1904.					
August[a]	5,000	3,680	4,240	0.342	0.39
September[a]	5,640	4,020	4,570	.369	.41
October	10,300	5,270	8,280	.668	.77
November	7,290	3,740	5,400	.435	.49
December			3,050	.246	.28
1905.[b]					
January			2,620	.211	.24
February			2,500	.202	.21
March	4,680		3,180	.256	.30
April	11,300	4,020	6,570	.530	.59
May	22,800	4,380	14,000	1.13	1.30
June	35,500	7,530	21,000	1.69	1.89
July	51,000	10,900	28,700	2.31	2.66
August	15,800	9,980	12,900	1.04	1.20
September	10,900	7,060	9,320	.752	.84
October	7,660	5,270	6,700	.540	.62
November	7,290	5,270	6,000	.484	.54
December			7,190	.580	.67
The year	51,000		10,100	.810	11.06

[a] Log jam August 20 to September 3; discharge values corrected.
[b] Gage heights for 1905 have been published in Water-Supply Paper No. 171. Discharge values are rated as follows: May to November, excellent; April, fair; remainder of the year, approximate. Ice conditions as follows: January 1 to March 29, December 1 to 31.

MISSISSIPPI RIVER AT ANOKA, MINN.

This station was established May 8, 1905. It is located at a highway bridge three-fourths mile southwest of Anoka. The station was temporarily discontinued from July 20, 1906, to August 10, 1906. The bench mark is a chiseled cross on the face of the stone in the lower wing wall of the left abutment of the bridge, the second stone of the bottom course. The mark is about 5 feet from the lower end of the wing wall; elevation, 11.19 feet above the gage datum. The conditions at this station are described in Water-Supply Paper No. 171, page 52.

Discharge measurements of Mississippi River at Anoka, Minn., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
September 16	R. Richards	764	4,600	2.36	12,200
November 3	E. F. Chandler	756	4,000	1.77	9,650
December 27	R. Richards	755	3,700	2.86	[a] 7,910
1906.					
April 12	Horton and Brennan	776	6,740	5.20	24,000
May 25	M. S. Brennan	781	6,250	4.50	22,200

[a] Ice measurement made at section 600 feet below bridge. Lower surface of ice at gage height, 1.90 feet; average thickness of ice, 1.06 feet.

Daily gage height, in feet, of Mississippi River at Anoka, Minn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	.....	2.3	4.25	6.0	4.8	.....	2.8	3.5	.....	6.3
2	.....	.....	.....	2.4	4.25	5.8	4.85	.....	2.8	3.35	.....	9.4
3	.....	.....	2.0	3.4	4.25	5.6	5.05	.....	2.8	3.35	.....	10.4
4	.....	2.3	.....	5.4	4.25	6.0	5.0	.....	2.8	3.2	.....	10.0
5	2.3	.....	.....	5.5	3.8	6.0	5.05	.....	2.7	3.0	.....	9.5
6	.....	.....	.....	4.5	3.8	6.45	4.9	.....	2.65	3.0	.....	9.5
7	.....	.....	.....	5.6	3.8	6.8	4.85	.....	2.65	2.8	2.8	9.3
8	.....	.....	.....	6.0	3.8	7.0	5.0	.....	2.6	2.8	2.8	9.3
9	.....	.....	.....	5.5	3.8	7.2	5.0	.....	2.3	2.6	2.75	.....
10	.....	2.5	.....	5.4	4.0	7.35	4.8	1.5	2.0	2.3	2.7	.....
11	.....	.....	2.4	5.5	4.2	7.25	4.8	1.5	1.5	2.3	2.7	.....
12	.....	.....	.....	5.3	4.25	7.2	4.25	1.5	1.5	2.2	2.7	.....
13	2.1	.....	.....	5.3	4.2	6.8	4.2	1.55	1.5	2.2	2.6	.....
14	.....	.....	.....	5.4	4.2	6.5	4.0	1.65	1.5	2.2	2.5	.....
15	.....	.....	.....	5.8	3.8	6.1	3.8	1.8	1.8	1.8	2.4	6.8
16	.....	.....	.....	5.97	3.4	5.6	3.55	1.8	1.8	1.8	2.4	.....
17	.....	.....	.....	5.97	3.4	5.15	3.5	1.8	1.8	1.8	2.35	.....
18	.....	.....	2.75	5.85	3.25	4.9	3.0	1.8	1.8	1.95	2.1	.....
19	.....	2.3	.....	5.8	3.2	4.85	2.8	1.8	1.85	2.0	1.9	.....
20	.....	.....	.....	5.6	3.4	4.85	2.55	1.85	1.85	2.0	2.8	.....
21	.....	.....	.....	5.4	3.5	4.5	.....	1.85	1.9	2.05	3.8	.....
22	2.2	.....	.....	5.4	3.55	4.5	.....	1.85	2.0	1.9	6.1	6.2
23	.....	.....	.....	5.1	.....	4.8	.....	1.85	2.0	1.8	6.9	.....
24	.....	2.3	2.7	4.8	.....	4.8	.....	1.85	2.35	1.8	7.6	.....
25	.....	.....	.....	4.25	4.5	4.7	.....	1.85	2.5	1.8	8.8	.....
26	.....	.....	.....	4.25	.....	4.55	.....	2.0	2.8	2.3	5.3	.....
27	2.2	.....	.....	4.25	4.5	4.55	.....	2.1	2.85	2.5	3.3	.....
28	.....	.....	.....	4.3	5.4	4.8	.....	2.5	3.0	2.8	2.8	.....
29	.....	.....	.....	4.8	6.0	4.85	.....	2.6	3.0	3.0	2.8	5.4
30	.....	.....	.....	4.25	6.0	4.85	.....	2.8	3.0	.....	3.5	.....
31	.....	.....	.....	.....	6.0	.....	.....	2.8	.....	.....	.....	.....

NOTE.—The river was frozen from January 1 to March 31; gage heights are to water surface in a hole in the ice, except during February, when the river at the gage was frozen to the bottom, and gage heights are to top of ice. The following comparative readings were taken:

Comparative ice and water gage heights of Mississippi River at Anoka, Minn.

Date.	Water surface.	Top of ice.	Thickness of ice at gage.
January 5	2.3	2.5	1.2
January 13	2.1	2.3	1.2
January 22	2.2	2.3	1.4
January 27	2.2	2.3	1.5
March 3	2.0	2.0	1.65
March 11	2.4	2.5	1.65
March 18	2.75	2.85	1.3
March 24	2.7	2.85	1.2

Ice conditions caused backwater November 20 to 26; also during the first part of December. River frozen entirely across December 15.

MISCELLANEOUS MEASUREMENT OF MISSISSIPPI RIVER.

The following miscellaneous measurement was made of the Mississippi River from the Chicago Great Western Railroad bridge at St. Paul, Minn.:

October 31, 1905: Width, 894 feet; area, 7,640 square feet; gage height, 5.54 feet; discharge, 16,100 second-feet.

CROW RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Crow River is formed by the junction of North and South forks. Below the junction the river is only 18 miles in length, while North and South forks are 96 and 80 miles long, respectively. With the exception of the Crow Wing this river is the largest tributary of the Mississippi above the Minnesota.

The basin of the Crow lies wholly within the State of Minnesota. It consists, principally, of rolling prairie, interspersed with groves of hard-wood timber, and is largely cultivated. The numerous lakes within its limits, some of which are 4 or 5 square miles in area, help to make the flow of the river uniform.

The stream is of value for water power, especially North Fork and the main stream below the junction.

CROW RIVER NEAR DAYTON, MINN.

This station was established April 13, 1906, and was discontinued July 21, 1906. It is located at the highway bridge at Berning's mill, about 13½ miles by road from Anoka, Minn., and about 7 miles up the valley from Dayton, at the mouth of the river.

The channel is straight for about 200 feet above and below the station. Berning's mill and dam are about 200 feet above the bridge. The mill uses only a small amount of the total flow. Water flows over the dam at all times. There is one channel at all stages. Both banks are of medium height and are but rarely or never overflowed. The bed of the stream is of coarse gravel and is permanent. The current is swift.

Discharge measurements are made from the lower side of the single-span highway bridge. The initial point for soundings is the inner face of the left cylinder pier.

The gage, which was read during 1906 by Joseph Berning, is a vertical staff attached to a pile near the left end of the bridge on the upstream side. The bench mark is a point between two chisel drafts on top of the casing of the upstream pier at the left end of the bridge. An arrow chiseled on the upstream side of the pier points toward the mark; elevation, 15.66 feet above the gage datum.

The high water of 1890, the highest for fifty years, corresponded to a gage height of 15.5 feet.

Discharge measurements of Crow River near Dayton, Minn., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
November 2	E. F. Chandler	160	509	3.79	570
1906.					
April 13	Horton and Brennan	168	907	6.53	2,010
May 26	M. S. Brennan	215	2,030	12.00	8,050

Daily gage height, in feet, of Crow River near Dayton, Minn., for 1906.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1	.....	5.4	13.8	8.0	17	7.5	6.0	9.4	6.2
2	.....	5.6	13.3	8.0	18	7.2	6.1	9.0	6.1
3	.....	5.8	12.8	7.9	19	7.0	6.1	8.7	6.0
4	.....	5.9	12.9	7.9	20	6.8	6.0	8.7	5.9
5	.....	5.8	12.5	7.9	21	6.6	6.9	8.8	5.7
6	.....	5.7	12.6	7.8	22	6.3	9.7	8.9	.....
7	.....	5.5	12.8	7.6	23	6.1	10.7	8.9	.....
8	.....	5.4	12.7	7,4	24	5.9	11.6	8.7	.....
9	.....	5.3	12.5	7.3	25	5.7	11.9	8.6	.....
10	.....	5.2	12.3	7.1	26	5.5	12.1	8.5	.....
11	.....	5.1	11.9	6.9	27	5.4	12.9	8.3	.....
12	.....	5.0	11.4	6.7	28	5.3	13.3	8.3	.....
13	6.5	5.4	10.9	6.5	29	5.3	13.6	8.3	.....
14	7.1	5.6	10.6	6.4	30	5.3	13.8	8.1	.....
15	7.7	5.8	10.1	6.3	31	.....	13.9	.....	.....
16	7.7	5.9	9.8	6.3					

Rating table for Crow River near Dayton, Minn., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.00	1,080	6.30	1,855	7.60	2,845	9.80	5,110
5.10	1,130	6.40	1,925	7.70	2,930	10.00	5,350
5.20	1,185	6.50	1,995	7.80	3,020	10.20	5,600
5.30	1,240	6.60	2,065	7.90	3,110	10.40	5,855
5.40	1,295	6.70	2,135	8.00	3,200	10.60	6,115
5.50	1,350	6.80	2,210	8.20	3,390	10.80	6,380
5.60	1,410	6.90	2,285	8.40	3,585	11.00	6,650
5.70	1,470	7.00	2,360	8.60	3,785	12.00	8,050
5.80	1,530	7.10	2,435	8.80	3,990	13.00	9,550
5.90	1,595	7.20	2,515	9.00	4,200	14.00	11,140
6.00	1,660	7.30	2,595	9.20	4,420		
6.10	1,725	7.40	2,675	9.40	4,645		
6.20	1,790	7.50	2,760	9.60	4,875		

NOTE.—The above table is based on three discharge measurements made during 1905-6. Its accuracy is wholly dependent on the accuracy of the three measurements which define it; an error in any one would involve a corresponding error in the rating at the stage of the measurement in question. The general form of the curve, however, appears to be very good.

Monthly discharge of Crow River near Dayton, Minn., for 1906.

[Drainage area, 2,540 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April 13-30	2,930	1,240	1,960	0.772	0.52
May	11,000	1,080	3,790	1.49	1.72
June	10,800	3,300	6,170	2.43	2.71
July 1-21	3,200	1,470	2,360	.929	.73

NOTE.—Values for 1906 are probably excellent. See rating table footnote.

RUM RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Rum River, so named on account of the color of its water, starts from the southwestern part of Mille Lacs, in east-central Minnesota, flows southward, and enters the east side of the Mississippi at Anoka,

7½ miles below the mouth of Crow River. Its basin is about 80 miles long and averages not over 19 miles in width. The large body of water at its head serves an important part in maintaining the flow during low water. The stream flows between banks of clay or mud, and where it crosses the ridge of granite which produces Sauk Rapids on the Mississippi there is a slight fall over rock in place.

Rum River has been largely used for lumbering, and its small tributaries have many dams, built for holding and flushing logs into the main river. The data collected in this basin are valuable for water-power purposes.

RUM RIVER NEAR ANOKA, MINN.

This station was established May 8, 1905, and was discontinued July 21, 1906. It is located at the highway bridge 6½ miles due north of Anoka, the distance by road being 7½ miles. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 54.

Discharge measurements of Rum River near Anoka, Minn., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
September 16	R. Richards	148	877	12.65	987
November 2	E. F. Chandler	149	939	13.16	1,190
December 28	R. Richards	145	488	13.26	[a] 765
1906.					
April 12	Horton and Brennan	200	1,950	17.66	4,480
May 26	M. S. Brennan	191	1,290	14.18	1,810

[a] Ice measurement; gage height to under side of ice 12.26 feet; ice about 1 foot thick. The discharge was about 60 per cent of the open-channel rating for gage height 13.26 feet.

Daily gage height, in feet, of Rum River near Anoka, Minn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1				15.2	13.8	16.2	13.9
2				15.3	13.6	16.45	14.0
3		13.25	13.85	15.4	13.4	16.3	13.9
4				15.6	13.65	15.95	13.8
5				15.9	13.8	15.9	13.65
6	13.1			16.6	13.8	15.6	13.5
7				17.55	13.7	15.7	13.0
8				18.0	13.85	16.15	13.0
9				18.45	13.75	16.95	12.9
10		13.15	13.75	18.55	13.7	18.98	12.8
11				18.2	13.45	20.45	12.75
12				17.9	13.4	21.3	12.75
13	13.25			17.5	13.7	21.15	12.7
14				17.6	14.0	20.15	12.7
15				17.6	13.9	19.0	12.65
16				17.5	13.7	18.25	12.6
17		13.25	13.65	17.4	13.65	16.85	12.65
18				17.35	13.6	16.25	12.6
19				17.45	13.45	15.5	12.5
20	13.1			17.4	13.4	14.6	12.45
21				17.1	13.5	13.85	12.4
22				16.8	13.8	13.7	
23				16.2	13.8	13.8	
24		13.45	13.4	15.5	13.8	13.75	
25				15.1	14.0	13.8	

Daily gage height, in feet, of Rum River near Anoka, Minn., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
26				14.5	14.2	13.95	
27	13.35			14.4	15.0	14.3	
28				14.15	15.45	14.5	
29				13.95	15.4	14.35	
30				13.9	15.6	13.85	
31			15.1		16.0		

NOTE.—The river was frozen January 1 to March 31; gage heights were to the water surface in a hole in the ice. The following comparative readings were taken:

Comparative water and ice gage heights on Rum River near Anoka, Minn.

Date.	Water surface.	Top of ice.	Thickness of ice.
January 6	13.1	13.15	1.1
January 13	13.25	13.35	1.2
January 20	13.1	13.2	1.2
January 27	13.35	13.4	1.4
February 3	13.25	13.3	1.4
February 10	13.15	13.2	1.5
February 17	13.25	13.3	1.6
February 24	13.45	13.5	1.5
March 3	13.85	13.9	1.5
March 10	13.75	13.8	1.4
March 17	13.65	13.7	1.5
March 24	13.4	13.5	1.6

Rating table for Rum River near Anoka, Minn., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
11.00	470	12.30	830	13.60	1,450	15.80	3,000
11.10	490	12.40	870	13.70	1,510	16.00	3,150
11.20	510	12.50	910	13.80	1,570	16.20	3,300
11.30	535	12.60	950	13.90	1,630	16.40	3,460
11.40	560	12.70	990	14.00	1,690	16.60	3,620
11.50	585	12.80	1,030	14.20	1,830	16.80	3,780
11.60	610	12.90	1,070	14.40	1,970	17.00	3,940
11.70	640	13.00	1,120	14.60	2,110	18.00	4,750
11.80	670	13.10	1,170	14.80	2,250	19.00	5,600
11.90	700	13.20	1,220	15.00	2,400	20.00	6,450
12.00	730	13.30	1,270	15.20	2,550	21.00	7,300
12.10	760	13.40	1,330	15.40	2,700	22.00	8,150
12.20	795	13.50	1,390	15.60	2,850		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1905–6. It is well defined between gage heights 11.7 feet and 14.5 feet. The table has been extended beyond these limits, being based on one measurement at gage height 17.66 feet.

Monthly discharge of Rum River near Anoka, Minn., for 1906.

[Drainage area, 1,430 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January			672	0.470	0.54
February			612	.428	.45
March			786	.550	.63
April	5,210	1,630	3,550	2.48	2.77
May	3,150	1,330	1,720	1.20	1.38
June	7,550	1,510	3,430	2.40	2.68
July 1–21	1,690	870	1,150	.804	.63

NOTE.—Values are rated as follows: January to March, approximate; April to July, excellent. Flow under ice cover estimated.

MINNESOTA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Minnesota River rises in Bigstone Lake, which forms part of the boundary between South Dakota and Minnesota, flows southeastward to the city of Mankato, in the northern part of Blue Earth County, where it makes an abrupt turn to the north, and continues in a northerly and northeasterly direction until it enters the Mississippi at a point midway between Minneapolis and St. Paul. The course of this river is generally marked by wide bottom lands. It has a sluggish current, affording few opportunities for the development of water power.

MINNESOTA RIVER NEAR MANKATO, MINN.

This station was established May 20, 1903, and was discontinued July 21, 1906. It is located at Sibley Park, 1 mile below the highway and railroad bridges across Blue Earth River and 1½ miles above the city bridge in Mankato. Blue Earth River joins the Minnesota about 500 feet above the station. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 56, where are given also references to publications that contain data for previous years.

Discharge measurements of Minnesota River near Mankato, Minn., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
November 1	E. F. Chandler	298	815	2.69	1,240
December 29	R. Richards	297	811	3.70	[a] 1,070
1906.					
April 11	Horton and Brennan	310	1,890	7.59	6,020
May 24	M. S. Brennan	308	1,730	5.81	4,300

[a] Ice measurement; gage height to under side of ice, 3 feet; ice thickness, about 0.8 foot. The discharge was about 55 per cent of the discharge as given by the open-channel rating for gage height 3.70 feet.

Daily gage height, in feet, of Minnesota River near Mankato, Minn., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	3.5	3.2	4.8	7.1	6.3	8.2	7.55
2	3.5	3.3	4.8	7.6	6.45	8.3	7.4
3	3.5	3.3	4.95	8.1	6.55	8.3	7.45
4	3.5	3.0	4.85	7.6	6.6	8.3	7.4
5	3.5	3.2	4.8	7.4	6.55	8.5	7.3
6	3.5	3.1	4.9	7.1	6.45	8.7	7.2
7	3.45	3.1	4.8	7.0	6.3	8.8	7.1
8	3.45	3.05	4.9	6.8	6.25	8.95	7.0
9	3.45	3.0	5.4	7.1	6.15	9.1	6.85
10	3.45	3.0	5.4	7.4	6.0	9.2	6.75
11	3.4	2.95	5.2	8.0	5.85	9.2	6.6
12	3.4	2.9	4.9	7.45	5.75	9.15	6.4
13	3.4	2.9	4.7	7.8	5.65	9.05	6.45
14	3.4	2.9	4.5	8.85	5.55	8.95	6.0
15	3.35	2.9	4.4	8.9	5.4	8.9	5.85

Daily gage height, in feet, of Minnesota River near Mankato, Minn., for 1906—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
16	3.4	2.9	4.15	9.2	5.3	8.8	5.6
17	3.4	2.9	3.95	9.3	5.3	8.7	5.4
18	3.4	2.9	3.6	9.25	5.5	8.55	5.3
19	3.35	2.9	3.6	9.1	5.55	8.65	5.15
20	3.35	3.1	3.6	8.85	5.55	8.6	5.0
21	3.35	3.2	3.3	8.6	5.35	8.45	4.8
22	3.35	3.4	3.3	8.3	5.75	8.4	.....
23	3.3	4.0	3.4	7.9	5.55	8.4	.....
24	3.25	4.45	3.1	7.5	5.7	8.3	.....
25	3.2	4.4	3.1	7.3	5.75	8.2	.....
26	3.05	4.4	3.25	7.05	5.8	8.1	.....
27	3.0	4.5	4.3	6.8	6.15	8.1	.....
28	3.0	4.6	4.25	6.55	6.55	8.1	.....
29	3.05	.....	4.65	6.45	7.0	8.1	.....
30	3.2	.....	5.1	6.3	7.6	8.1	.....
31	3.2	.....	5.45	.....	8.0	.....	.....

NOTE.—Ice conditions January 1 to April 2.

Rating table for Minnesota River near Mankato, Minn., for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.80	3,090	5.80	4,270	6.80	5,610	7.80	7,010
4.90	3,200	5.90	4,400	6.90	5,750	7.90	7,150
5.00	3,310	6.00	4,530	7.00	5,890	8.00	7,300
5.10	3,430	6.10	4,660	7.10	6,030	8.20	7,600
5.20	3,550	6.20	4,790	7.20	6,170	8.40	7,900
5.30	3,670	6.30	4,920	7.30	6,310	8.60	8,200
5.40	3,790	6.40	5,050	7.40	6,450	8.80	8,500
5.50	3,910	6.50	5,190	7.50	6,590	9.00	8,800
5.60	4,030	6.60	5,330	7.60	6,730	9.20	9,100
5.70	4,150	6.70	5,470	7.70	6,870		

NOTE.—The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1905 and 1906. It is well defined between gage heights 2.8 feet and 8.6 feet. On account of changes at gaging section, measurements of previous years were not applicable. For low stages this table gives over 25 per cent increase over the 1903 table.

Monthly discharge of Minnesota River near Mankato, Minn, for 1906.

[Drainage area, 13,400 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April	9,250	4,920	6,980	0.521	0.58
May	7,300	3,670	4,650	.347	.40
June	9,100	7,450	8,160	.609	.68
July 1-21	6,660	3,090	5,120	.382	.30

NOTE.—Values for 1906 are excellent.

CHIPPEWA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Chippewa River rises in the southeastern part of Ashland County, Wis., flows southwestward, and unites with the Mississippi near Wabash, Minn. Its principal tributary is Flambeau River, which enters from the east, in Gates County.

A. BRUNETT FALLS, CHIPPEWA RIVER, WISCONSIN.

B. LOWER PITCH OF BIG FALLS, FLAMBEAU RIVER, WISCONSIN

The Chippewa is one of the most important power streams in Wisconsin. There are some 33 feet of fall at Chippewa Falls. Between the falls and the mouth of the Flambeau, 43 miles, there is a fall of 244 feet, 116 feet of this being concentrated in five falls and rapids. The large flow of the Chippewa and the use of storage reservoirs to maintain the summer flow gives the stream unusual value as a source of power.

One of the best powers on Chippewa River, and one most cheaply developed, is found at Brunett Falls (Pl. III, A), in sec. 18, T. 31 N., R. 6 W. It belongs to Cornell University, which also owns the adjacent land as well as the water rights. The best location for the dam would be about 650 feet above the foot of the rapids, where a 35-foot dam would create a large reservoir, backing the water up to the rapids at Holcombe, 5½ miles above. The river at the dam site is narrow (70 or 80 feet), while the banks are high granite ledges; the plans are said to contemplate a dam 200 feet long. A steel wagon bridge has recently been built across the river immediately below.

CHIPPEWA RIVER AT CHIPPEWA FALLS, WIS.

The United States Weather Bureau has maintained a station at this point since 1900. June 1, 1906, the Geological Survey began making discharge measurements at the highway bridge, 2,500 feet below the dam at Chippewa Falls.

The channel is straight for 500 feet above the station and for a considerable distance below. The left bank is low and liable to overflow; the right bank is formed by a railroad embankment, which is under water in high floods. The bed of the stream is gravel and sand and is probably permanent. The current is swift.

Discharge measurements are made from the lower side of the steel highway bridge. The initial point for soundings is the inner face of the right abutment at the downstream side.

The gage is an iron staff attached to the downstream face of the first pier from the right bank. The gage readings for 1906 were furnished by N. O. Swift, the United States Weather Bureau observer at Chippewa Falls.

The river stage during the "sawing season" fluctuates very rapidly at times, due to the storage of water at Holcombe by the lumber company. This reservoir is opened two or three times a week to flood logs to the sawmill.

A measurement was made at this station on June 1, 1906, by M. S. Brennan, giving the following results:

Width, 721 feet; area, 4,700 square feet; gage height, 6.70 feet; discharge, 18,000 second-feet.

Daily gage height, in feet, of Chippewa River at Chippewa Falls, Wis., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		5.0	4.0	8.2	2.0	1.7	2.3	1.5	3.9	3.0
2		4.3	4.0	2.3	1.8	1.5	1.4	1.8	3.6	2.7
3		5.5	4.2	5.0	2.4	1.0	1.5	3.0	3.4	2.4
4		6.3	4.4	4.0	2.3	1.4	4.6	1.8	3.2	2.2
5		8.0	5.0	3.1	2.0	1.3	1.8	1.5	3.1	2.0
6		7.9	5.1	3.6	2.4	1.5	1.5	1.3	3.0	1.9
7		7.8	5.4	3.1	2.3	3.0	1.8	1.2	3.0	1.8
8		8.0	4.5	5.1	1.0	1.9	1.5	1.0	3.0	1.8
9		9.0	2.5	6.0	1.5	2.3	1.4	1.2	3.8	1.8
10		9.8	2.3	5.6	2.0	2.4	2.4	1.2	3.8	1.8
11		9.9	2.0	5.1	2.3	1.5	1.5	3.3	3.6	1.8
12		9.5	1.8	5.0	1.5	1.3	1.6	1.3	3.4	1.9
13		9.6	2.3	4.0	1.6	1.9	1.7	1.3	3.3	2.0
14		10.0	2.9	3.9	1.5	1.2	1.8	1.4	3.2	2.0
15		11.5	5.8	3.5	2.0	1.7	3.0	1.5	2.7	2.0
16		11.4	5.0	3.3	2.4	1.4	3.2	1.7	2.6	2.0
17		10.5	2.3	2.3	2.7	1.3	6.5	1.8	2.5	2.0
18		9.3	4.3	3.5	1.8	1.4	3.6	1.8	2.8	2.0
19		8.8	4.4	1.8	2.0	1.3	2.6	1.5	3.3	2.0
20		7.4	2.9	1.5	1.9	1.2	2.8	1.5	3.0	2.0
21		8.0	3.0	1.9	1.7	1.5	2.5	1.7	2.8	2.0
22		7.8	1.8	2.0	1.1	1.8	2.8	2.0	2.7	2.0
23		7.4	4.0	2.4	1.3	4.0	3.0	2.3	2.5	2.0
24		7.0	5.7	1.0	1.0	1.8	6.8	2.4	2.2	2.0
25		7.3	2.4	1.5	1.8	4.5	3.8	3.0	2.0	2.0
26		6.3	3.8	2.5	1.5	2.8	3.5	5.1	2.2	2.0
27		5.6	5.5	2.7	1.6	4.2	2.5	5.0	2.5	2.0
28		5.0	6.6	2.8	1.5	1.8	2.3	5.0	3.0	2.0
29		4.4	6.8	3.3	1.2	2.7	2.5	4.9	3.3	2.0
30		4.2	5.9	1.0	1.0	1.5	2.4	4.6	3.4	2.0
31	3.6	.....	5.7	.....	1.5	1.3	.....	3.8	.....	2.0

NOTE.—There were ice conditions January 1 to March 31; also December 13 to 31.

CHIPPEWA RIVER NEAR EAU CLAIRE, WIS.

This station was established November 13, 1902. It is located 2 miles below Eau Claire, at a suburb known as Shawtown. The river stage during the "sawing season" fluctuates very rapidly at times, owing to the lumber company at Chippewa Falls storing water about 30 miles above the falls in a reservoir which is opened two or three times a week to flood logs to the sawmill. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 59, where are given also references to publications that contain data for previous years.

Discharge measurements of Chippewa River near Eau Claire, Wis., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 25	M. S. Brennan	332	2,770	4.82	[a] 2,760
April 25	do	425	4,870	9.45	17,100
June 2	do	355	3,650	6.52	7,980

[a] Ice measurement; river partly open. Gage height to bottom of ice, 3.92 feet; ice 1 to 1.2 feet thick. Discharge was about 75 per cent of the open-channel rating for gage height, 4.82 feet.

Daily gage height, in feet, of Chippewa River near Eau Claire, Wis., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.62	4.91	5.73	8.38	7.66	10.30	5.88	5.72	8.95	5.32	7.29	6.91
2				9.57	7.58	6.22	8.44	5.06	4.76	5.28	7.04	6.76
3				10.90	7.79	9.00	6.64	4.30	5.23	6.60	7.19	5.81
4				12.27	8.30	7.13	6.12	4.34	9.55	5.40	6.99	6.62
5		4.95	5.45	13.48	8.76	6.20	5.42	3.52	5.82	5.18	6.74	6.04
6				12.46	8.52	7.18	5.76	4.29	4.83	4.85	6.57	5.56
7				12.25	9.00	6.80	7.52	7.92	5.36	4.26	6.55	5.25
8			5.15	12.25	9.00	9.65	4.35	5.51	4.98	4.24	6.76	5.08
9		5.05		12.90	6.78	9.82	5.20	5.27	4.48	4.52	6.78	5.07
10				13.55	7.16	9.24	5.22	7.87	6.25	4.36	7.20	4.86
11				13.50	7.44	8.00	6.18	5.52	5.35	6.40	6.80	5.28
12		5.19	5.21	12.99	6.86	8.92	5.32	3.68	4.79	5.34	6.92	5.34
13				12.95	6.60	7.58	4.98	6.62	4.82	5.04	6.65	5.56
14	4.25			13.73	10.06	7.50	5.13	5.05	5.04	3.55	6.54	5.46
15		5.00	4.96	14.86	10.26	6.84	5.25	4.62	6.12	4.82	5.95	5.75
16				14.71	8.77	6.74	5.58	4.51	6.50	4.90	6.55	5.12
17				13.55	7.39	6.42	6.29	4.52	7.78	4.64	6.20	5.65
18				12.62	7.95	7.30	5.28	6.81	6.84	5.12	6.40	5.42
19		5.24	4.95	12.08	8.26	5.22	5.60	5.08	6.59	4.45	6.76	5.48
20	4.21			11.60	6.60	4.90	5.72	4.03	6.33	5.29	6.54	5.06
21				11.36	7.66	5.02	5.78	4.56	5.66	4.84	6.68	5.04
22		5.09		11.20	6.08	5.60	4.30	4.77	6.25	5.59	5.76	5.14
23				10.41	6.82	8.51	4.22	8.73	6.45	5.88	6.10	4.76
24	5.13			10.02	10.06	5.26	5.04	5.28	7.68	7.02	5.98	5.41
25	4.82		5.42	9.62	6.75	5.04	6.69	10.20	6.70	6.28	5.22	4.56
26		5.23	4.88	9.28	8.16	6.11	5.32	5.32	6.34	8.51	6.15	4.58
27			5.32	8.76	9.82	6.41	4.77	8.33	5.95	9.10	6.57	4.89
28			5.42	8.45	10.94	6.86	4.88	5.54	5.62	8.54	7.18	4.81
29	4.65		5.28	8.07	11.05	8.87	3.56	9.33	6.22	8.22	7.43	4.82
30			5.50	7.36	9.82	5.54	4.72	5.59	5.38	7.84	7.34	4.38
31			7.47		9.45		4.52	5.30		7.60		4.82

NOTE.—River frozen January 1 to March 30. From January 1 to about February 20 and March 25 to 30 there was an open channel west of the gage which varied in width during this period from 50 to 180 feet. The river was open about 150 feet below the gage January 1 to February 15 and about 50 feet above the gage throughout the ice period. Fluctuations of daily gage heights during the open period are due almost wholly to "flooding for logs" by lumbermen. The following comparative readings were taken:

Comparative water and ice gage readings of Chippewa River near Eau Claire, Wis.

Date.	Water surface.	Top of of ice.	Thickness of ice.
January 20	4.2	4.8	1.0
January 24			1.1
January 29	4.65	4.95	1.1
February 1	4.9	5.0	1.1
February 5	4.95	5.15	1.2
February 9	5.05	5.25	1.4
February 12	5.2	5.4	1.6
February 15	5.0	5.05	1.7
February 19	5.25	5.35	1.9
February 22	5.1	5.2	1.5
February 26	5.25	5.45	1.3
March 1	5.75	5.8	.9
March 5	5.45	5.5	1.0
March 8	5.15	5.25	.8
March 12			1.5
March 15	4.95	5.05	.9
March 19	4.95	5.05	.9

Rating table for Chippewa River near Eau Claire, Wis., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.50	1,040	4.90	3,820	6.30	7,360	8.40	13,600
3.60	1,210	5.00	4,050	6.40	7,640	8.60	14,240
3.70	1,390	5.10	4,280	6.50	7,920	8.80	14,890
3.80	1,570	5.20	4,520	6.60	8,200	9.00	15,550
3.90	1,760	5.30	4,760	6.70	8,480	9.20	16,210
4.00	1,950	5.40	5,000	6.80	8,770	9.40	16,890
4.10	2,140	5.50	5,250	6.90	9,060	9.60	17,570
4.20	2,340	5.60	5,500	7.00	9,350	9.80	18,250
4.30	2,540	5.70	5,760	7.20	9,930	10.00	18,950
4.40	2,740	5.80	6,020	7.40	10,530	11.00	22,550
4.50	2,950	5.90	6,280	7.60	11,130	12.00	26,350
4.60	3,160	6.00	6,550	7.80	11,730	13.00	30,350
4.70	3.380	6.10	6,820	8.00	12,350	14.00	34,500
4.80	3,600	6.20	7,090	8.20	12,970	15.00	38,750

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1902–1906. It is well defined between gage heights 4 feet and 15 feet.

Monthly discharge of Chippewa River near Eau Claire, Wis., for 1906.

[Drainage area, 6,740 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft per sq. mile.	Depth in inches.
April	38,100	10,400	24,900	3.69	4.12
May	22,700	6,770	13,500	2.00	2.31
June	20,000	3,820	10,000	1.48	1.65
July	13,700	1,140	5,350	.794	.92
August	19,600	1,330	6,220	.923	1.06
September	17,400	2,910	6,970	1.03	1.15
October	15,900	1,120	6,270	.930	1.07
November	10,600	4,570	8,310	1.23	1.37
December	9,090	2,700	4,810	.714	.82

NOTE.—Values for 1906 are excellent. During January, February, and March the flow probably seldom exceeded 3,000 second-feet and may have attained a minimum of 1,500 second-feet, or less.

FLAMBEAU RIVER NEAR LADYSMITH, WIS.

This station was established February 13, 1903. It is located three-fourths mile south of the Minneapolis, St. Paul and Sault Ste. Marie Railway station, three-fourths mile south of Ladysmith, and one-half mile below the dam of the Menasha Pulp Company. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 62, where are given also references to publications that contain data for previous years.

No powers have been developed on Flambeau River for 70 miles above Ladysmith, but a fall of 353 feet in this distance insures many opportunities for development. At two localities—Little Falls and Big Falls—the power possibilities are of special importance. The first is in the NW. ¼ sec. 21, T. 35 N., R. 5 W., and is owned by A. J. McGilvary and B. D. Viles, of Chippewa Falls. A 15-foot dam at the head of the first rapids would give a head of about 25 feet at the foot of the rapids a short distance below. Big Falls, owned by

the John Heim Company, of Tony, Wis., is 6 miles above Little Falls, in sec. 35, T. 36 N., R. 5 W. There is a descent of 25 feet here in a short distance, concentrated in three pitches, a view of one of which is shown in Pl. III, B.

Discharge measurements of Flambeau River near Ladysmith, Wis., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 26	M. S. Brennan	344	501	16.13	[a] 632
April 16	Horton and Brennan	380	2,630	20.74	10,800

[a] Entirely frozen over. Gage height to bottom of ice, 15.33 feet; thickness of ice varied from 0.8 to 2 feet; water surface 0.3 to 0.5 foot below ice surface. The discharge was about 40 per cent of the open-channel rating at gage height 16.13 feet.

Daily gage height, in feet, of Flambeau River near Ladysmith, Wis., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	16.72	.....	.....	16.92	17.82	17.35	16.80	15.20	16.15	16.15	20.25	19.55
2	16.90	.....	.....	16.92	18.05	17.30	16.92	15.75	16.25	15.70	20.25	19.00
3	16.85	.....	.....	17.00	17.65	17.15	17.10	16.20	16.12	15.80	20.30	.....
4	17.35	16.80	17.10	17.85	18.30	16.90	16.80	15.25	16.10	15.40	20.50	.....
5	16.65	.....	.....	18.15	18.60	16.82	16.82	15.70	16.05	16.00	20.10	.....
6	17.10	.....	.....	18.20	18.55	17.15	16.20	17.15	16.10	15.20	20.55	.....
7	.....	.....	.....	18.05	18.20	17.78	16.35	17.30	16.35	15.80	20.05	.....
8	.....	.....	.....	17.45	17.78	18.25	16.10	16.95	15.50	14.90	19.55	.....
9	.....	.....	.....	18.15	17.52	17.90	16.35	16.30	15.55	15.75	19.40	.....
10	.....	.....	.....	18.38	17.40	18.20	16.38	16.20	15.70	15.85	19.90	.....
11	.....	17.10	15.60	18.30	17.18	17.72	16.40	16.35	15.60	15.72	19.85	.....
12	.....	.....	.....	19.05	17.10	17.45	16.52	16.20	15.65	15.70	17.05	.....
13	.....	.....	.....	19.65	17.10	17.40	16.60	16.15	16.65	15.70	16.45	.....
14	16.70	.....	.....	20.50	17.02	16.85	16.35	16.00	17.12	15.65	16.35	.....
15	.....	.....	.....	20.72	17.25	16.80	16.20	16.00	17.15	15.60	16.50	.....
16	.....	.....	.....	20.65	17.00	16.65	16.40	15.80	17.08	15.75	16.70	.....
17	.....	.....	17.10	20.48	17.50	16.55	16.30	15.90	17.10	15.65	16.75	.....
18	.....	.....	.....	20.35	16.68	16.30	16.20	15.70	17.12	17.05	16.70	.....
19	.....	17.00	.....	20.40	16.68	16.10	16.10	15.35	17.10	[a] 18.50	17.00	.....
20	.....	.....	.....	20.40	16.85	16.10	15.95	15.60	16.78	19.75	16.60	.....
21	16.30	.....	.....	20.40	16.65	16.32	16.60	16.45	16.28	19.65	16.30	.....
22	.....	.....	.....	20.10	16.90	16.60	15.88	16.75	17.02	19.70	16.55	.....
23	.....	.....	.....	19.75	16.95	16.50	15.75	16.80	17.08	19.5	18.05	.....
24	.....	.....	.....	19.45	17.32	16.75	15.68	17.00	16.15	19.75	19.30	.....
25	.....	17.4	16.60	19.00	17.32	16.58	16.00	16.65	16.65	20.20	19.35	.....
26	.....	.....	.....	18.70	17.50	16.60	15.55	17.05	16.58	24.40	19.30	.....
27	.....	.....	.....	18.45	17.80	16.62	15.70	16.55	16.25	20.50	19.45	.....
28	16.70	.....	.....	18.05	17.70	16.50	15.65	16.45	16.40	20.45	19.45	.....
29	.....	.....	.....	18.05	17.38	16.82	15.75	16.35	16.20	20.20	19.50	.....
30	.....	.....	.....	17.90	17.80	17.40	15.55	16.20	16.55	20.50	19.55	.....
31	.....	.....	.....	.....	17.50	.....	15.00	16.50	.....	20.40	.....	.....

[a] October 18 a dam below the station was closed, raising the water at the section.

NOTE.—River frozen January 6 to April 4, approximately; also December 3 to 31. During January the average ice thickness was about 1 foot, while during February and March it was 1.6 feet.

Rating table for Flambeau River near Ladysmith, Wis., from January 1, 1906, to October 17, 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
14.90	535	16.20	1,735	17.50	3,700	19.40	7,710
15.00	600	16.30	1,855	17.60	3,890	19.60	8,170
15.10	670	16.40	1,980	17.70	4,090	19.80	8,630
15.20	745	16.50	2,110	17.80	4,300	20.00	9,090
15.30	825	16.60	2,245	17.90	4,510	20.20	9,550
15.40	910	16.70	2,385	18.00	4,720	20.40	10,030
15.50	1,000	16.80	2,530	18.20	5,140	20.60	10,510
15.60	1,090	16.90	2,680	18.40	5,560	20.80	11,000
15.70	1,185	17.00	2,835	18.60	5,980	21.00	11,500
15.80	1,285	17.10	2,995	18.80	6,400	22.00	14,100
15.90	1,390	17.20	3,160	19.00	6,820	23.00	16,800
16.00	1,500	17.30	3,330	19.20	7,260	24.00	19,600
16.10	1,615	17.40	3,510				

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1906. It is well defined between gage heights 15.5 feet and 21 feet. Owing to the closure of a dam below the section the table is not applicable after October 17, 1906.

Monthly discharge of Flambeau River near Ladysmith, Wis., for 1906.

[Drainage area, 2,120 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April (5–30)	10,800	3,600	7,310	3.45	3.34
May	5,980	2,320	3,680	1.74	2.01
June	5,240	1,620	2,900	1.37	1.53
July	3,000	600	1,770	.835	.96
August	3,330	745	1,860	.877	1.01
September	3,080	1,000	2,730	1.29	1.44
October (1–17)	1,340	910	1,170	.552	.35

NOTE.—Values for 1906 are probably excellent. During the frozen period the discharge probably seldom exceeded 1,500 second-feet and may have declined to a minimum of 500 or less. See ice measurement.

FLAMBEAU RIVER SURVEY.

In order to point out the power possibilities along the Flambeau River a survey was made during 1906 from Flambeau to a point near the western border of Lac Du Flambeau Indian Reservation; the section from the mouth to Flambeau had been surveyed by the Geological Survey in 1902. From the data collected sheets have been prepared showing a profile of the water surface, a plan of the river, contour along the bank, and prominent natural or artificial features. The results of this survey have been published on separate sheets and may be had on application to the Director of the Geological Survey.

BLACK RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Black River rises in the southeastern part of Taylor County, Wis., at an elevation between 1,300 and 1,400 feet above tide, flows in a general southwesterly direction for a distance of 128 miles, and joins

the Mississippi about 10 miles above the town of La Crosse. Its basin, wedged in between that of the Wisconsin on the east and the Chippewa on the west, is long and narrow, being at one point scarcely more than 3 miles wide. The total area drained is 2,272 square miles.

The surface of the basin is gently rolling or level, and the country about the lower part of the river is well settled and under cultivation. The southern portion of the pine region crosses the basin between 60 and 80 miles from the mouth of the river, and all of the upper half of the area is forested. There are a few lakes at the upper waters, but the basin is not well supplied with natural reservoirs.

The river has a total fall of about 750 feet between source and mouth, or over 4.5 feet a mile. At Black River Falls there are very heavy rapids for a short distance, over hard granite rock. The tributaries, which are characterized by many rapids and moderate falls, are all small streams of little importance, though they furnish power for a few small mills.

BLACK RIVER SURVEY.

In order to point out the power possibilities along Black River a survey was made during 1906 from Black River Falls to Wisconsin Central Railway crossing. From the data collected on this survey sheets have been prepared showing a profile of the water surface, a plan of the river, contour along the bank, and prominent natural or artificial features. The results of this survey have been published on separate sheets and may be had upon application to the Director of the Geological Survey.

BLACK RIVER AT NEILLSVILLE, WIS.

This station was established April 7, 1905. It is located at the lower highway bridge at Neillsville, Wis., about 40 rods below the Chicago, St. Paul, Minneapolis and Omaha Railway bridge. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 65.

Discharge measurements of Black River at Neillsville, Wis., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 25	M. S. Brennan	147	198	4.30	[a] 152
April 24	do	165	484	4.75	819
June 3	do	160	436	4.46	752

[a] Entirely frozen over; gage height given to water surface; ice 1.3 feet thick. The discharge was 22 per cent of the open-channel rating for gage height 4.30 feet.

Daily gage height, in feet, of Black River at Neillsville, Wis., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.5	4.1	5.1	9.4	4.2	5.1	3.7	3.2	3.2	2.7	4.2	5.5
2	3.3	4.1	5.0	11.8	4.6	4.8	3.5	3.0	4.5	2.9	3.9	5.2
3	3.4	4.1	5.2	12.0	5.0	4.3	3.9	2.8	4.5	2.7	3.8	4.9
4	3.5	4.1	5.0	11.6	5.2	4.0	4.2	2.6	4.7	2.7	3.9	4.5
5	3.4	4.0	4.9	11.3	5.1	4.2	4.0	2.8	4.5	2.7	3.8	4.2
6	3.4	4.0	4.9	11.0	4.7	6.3	3.6	3.0	3.0	2.5	3.7	3.8
7	3.5	4.0	4.8	10.6	4.4	6.9	3.3	2.9	3.8	2.5	3.7	4.2
8	3.5	3.9	4.8	11.4	4.2	6.6	3.1	2.8	3.4	2.5	3.7	4.5
9	3.4	3.9	5.3	10.7	4.3	5.9	3.0	2.4	2.9	2.5	3.6	4.7
10	3.5	3.8	5.1	10.0	4.3	5.4	3.1	2.4	3.0	2.5	3.7	4.8
11	3.5	3.8	4.9	8.9	4.1	4.6	3.0	2.4	3.0	2.7	3.6	4.8
12	3.5	3.8	4.9	8.7	3.9	4.1	3.0	2.5	3.0	2.4	3.6	4.8
13	3.5	4.0	4.8	8.5	6.9	3.8	2.8	2.4	3.0	2.4	3.3	4.6
14	3.5	3.9	4.7	8.8	7.3	3.5	2.8	2.4	2.9	2.4	3.2	4.3
15	3.6	3.9	4.6	8.5	6.6	3.3	2.8	2.3	2.9	2.4	3.3	4.3
16	3.6	3.9	4.5	7.6	5.9	3.2	2.7	2.3	3.3	2.5	3.2	4.5
17	3.7	3.8	4.5	6.7	5.4	3.1	2.7	2.4	3.3	2.5	4.1	4.6
18	3.8	3.9	4.4	6.2	4.9	3.0	2.6	2.4	3.4	2.7	5.1	4.6
19	3.8	3.9	4.3	6.0	4.5	2.9	2.7	2.3	3.3	2.7	4.8	4.5
20	3.8	4.1	4.3	6.0	4.1	3.0	2.7	2.3	3.2	3.0	4.6	.....
21	4.0	4.2	4.4	5.8	4.0	3.1	2.6	2.2	3.2	3.5	4.4	.....
22	4.0	4.3	4.3	5.4	4.0	3.6	2.6	2.6	3.1	3.4	3.7	.....
23	4.0	4.4	4.2	4.9	4.1	3.9	2.2	3.0	3.0	3.4	3.8	.....
24	4.0	4.6	4.1	4.8	4.2	4.1	2.1	3.8	3.2	3.7	3.6	.....
25	4.0	4.8	4.2	4.4	6.0	3.9	2.1	4.1	3.2	4.2	3.8	.....
26	4.0	4.9	5.1	4.4	5.9	3.7	2.4	4.4	3.1	5.2	5.5	.....
27	4.1	5.1	6.0	4.3	9.3	3.9	2.4	4.3	3.0	5.2	6.7	.....
28	4.1	5.1	6.6	4.2	8.3	4.1	2.5	4.1	3.0	4.9	6.6	.....
29	4.1	.....	7.2	4.1	7.2	4.2	2.4	3.9	2.9	4.7	6.3	.....
30	4.1	.....	[a] 11.5	4.2	6.5	3.9	4.0	3.7	2.8	4.5	6.2	.....
31	4.1	.....	8.5	.....	5.8	.....	3.7	3.4	.....	4.2	.....	.....

[a] Ice jam.

NOTE.—Ice conditions January 1 to March 30 and December 20 to 31.

Rating table for Black River at Neillsville, Wis., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.10	20	3.60	338	5.10	1,185	7.20	2,850
2.20	26	3.70	379	5.20	1,250	7.40	3,050
2.30	34	3.80	424	5.30	1,315	7.60	3,250
2.40	44	3.90	473	5.40	1,385	7.80	3,460
2.50	56	4.00	525	5.50	1,455	8.00	3,680
2.60	70	4.10	579	5.60	1,525	8.20	3,900
2.70	86	4.20	635	5.70	1,600	8.40	4,120
2.80	105	4.30	692	5.80	1,675	8.60	4,340
2.90	126	4.40	750	5.90	1,750	8.80	4,580
3.00	150	4.50	810	6.00	1,825	9.00	4,820
3.10	177	4.60	870	6.20	1,985	10.00	6,020
3.20	205	4.70	930	6.40	2,145	11.00	7,300
3.30	235	4.80	990	6.60	2,310	12.00	8,700
3.40	267	4.90	1,055	6.80	2,480		
3.50	301	5.00	1,120	7.00	2,660		

NOTE.—The above table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1905 and 1906. It is well defined between gage heights 3.3 feet and 7.7 feet. Beyond these limits the discharge is only approximate.

Monthly discharge of Black River at Neillsville, Wis., for 1906.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
April	8,700	579	3,800
May	5,180	473	1,440
June	2,570	126	750
July	635	20	184
August	750	26	188
September	930	105	274
October	1,250	44	298
November	2,400	205	755
December (1-19)	1,460	424	874

NOTE.—Values for 1906 are good, except July and August, which are fair. During the frozen period the discharge probably seldom exceeded 500 second-feet and attained a minimum of at least 150, and probably much less.

WISCONSIN RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Wisconsin River, the largest stream in the State of Wisconsin, rises in Lac Vieux Desert, a sheet of water about 10 square miles in area which lies directly on the line separating the upper peninsula of Michigan from Wisconsin, and enters the Mississippi just below Prairie du Chien. The river flows southward for 300 miles to the city of Portage; it then turns sharply and flows west and southwest for the remainder of the distance to its mouth. Its drainage basin, 12,280 square miles in extent, has an average width of about 50 miles and is 225 miles long. From source to mouth the distance by water is approximately 400 miles. The stream lies for the most part in the eastern half of the basin, and below the bend at Portage it flows within about 10 miles of its southern edge.

The country drained is rolling, and in places decided ridges break the surface. In the headwater region are many lakes and tamarack swamps, and all the way down to Portage there is more or less swamp land between the ridges. The wooded (pine) country extends from the Michigan boundary line down to within 40 miles, by river, of the city of Portage. Below that point the pine disappears, and a semi-prairie region gradually takes the place of the woods. In the southern part of the basin the Baraboo ranges of quartzite pass east and west from 400 to 700 feet above the surrounding country, and the bluffs along the lower river, especially on the south side, form prominent ramparts to the valley. Back from these the land is level or undulating.

Owing to the form of the basin and the position of the river in it there are no very large tributaries. The wooded character of all the upper portion of the drainage area aids in maintaining the flow of the stream during the dry and cold seasons and makes the Wisconsin one of the most uniform in flow of all the large tributaries of the Mississippi.

The elevation of the headwaters is 1,532 feet above the sea, and that of the mouth about 600 feet. Hence in a course estimated to be 407 miles the river falls 932 feet, or about 2.29 feet per mile. The most rapid part is in the upper portion of the stream, and here are the available water powers. At the rapids the river flows over a rocky bed, but at intermediate places the bed is largely made up of sand, gravel, and bowlders.

In the 53 miles between the foot of the upper dam at Merrill and the foot of the Rhinelander dam the river has a natural descent of 277 feet, an average of 5.2 feet per mile. In this stretch, besides several other fine powers, are included Grandfather Rapids, the largest water power on the river, developed or undeveloped. These rapids begin in the NE. ¼ sec. 30, T. 33 N., R. 6 E., and extend to the SW. ¼ sec. 31, a distance of 1½ miles, and are the most noted rapids on the river. A view of them is shown in Pl. IV, *A*. The descent in this distance is 89½ feet. The high bank and the bed of the river are in hard rock. For nearly thirty years the Wisconsin River Logging Association has maintained three logging dams on these rapids. It is probable that the cheapest method of developing this power would be to construct three dams of 30 feet head each, and that the power could be best employed by paper mills. The site is about midway in the 20-mile stretch from Merrill to Tomahawk.

About 1.5 miles above Grandfather Rapids are some small rapids where an 8.9-foot dam would back the water to the foot of Grandmother Rapids.

WISCONSIN RIVER SURVEY.

In order to point out the power possibilities along the Wisconsin River, a survey was made during 1906 between Sauk City and Dekorra and between Lewiston Station and Jersey City. From the data collected sheets have been prepared, showing a profile of the water surface, a plan of the river, contour along the bank, and prominent natural or artificial features. The results of this survey have been published on separate sheets and may be had upon application to the Director of the Geological Survey.

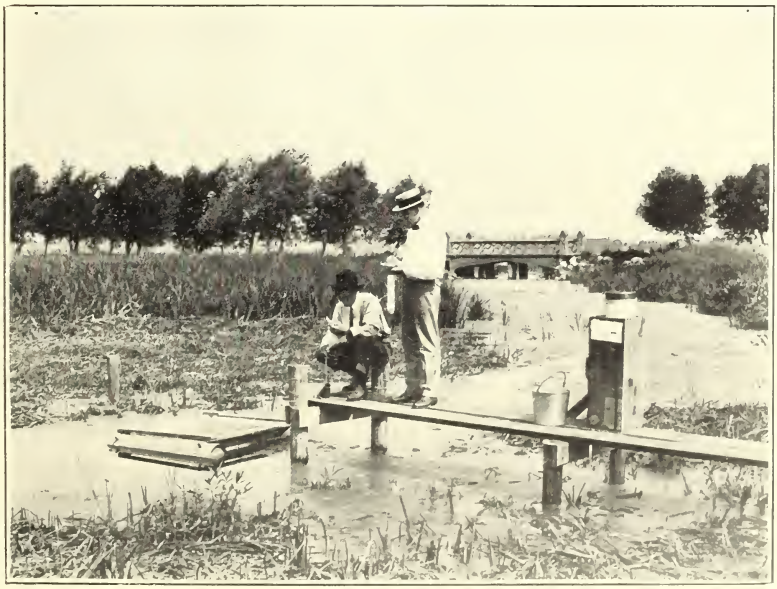
EAU CLAIRE RIVER SURVEY.

In order to point out the power possibilities along the Eau Claire River, a survey was made during 1906 from the mouth to Johnson. From the data collected sheets have been prepared, showing a profile of the water surface, a plan of the river, contour along the bank, and prominent natural or artificial features. The results of this survey have been published on separate sheets and may be had upon application to the Director of the Geological Survey.

WISCONSIN RIVER NEAR RHINELANDER, WIS.

This station was established December 1, 1905. It is located about 8 miles southwest of Rhinelander, Wis., at the highway bridge about 400 feet below Forbes and Wixson's dam and power station.

A. GRANDFATHER RAPIDS, WISCONSIN RIVER, WISCONSIN.



B. EVAPORATION STATION, MADISON, WIS.

The channel is straight for 400 feet above and below the bridge. The banks are of medium height, but do not overflow. The bed of the river is rocky and is permanent; the current is swift.

Discharge measurements are made from the lower side of the two-span highway bridge; the initial point for soundings is the right end of the downstream railing of the bridge.

A standard chain gage, which was read during 1906 by E. H. Miller and Charles Hagen, is attached to the upstream side of the bridge. Length of chain, 18.97 feet. The bench mark is the head of the right bolt on the upstream side of the top of the right upstream cylinder pier. It is marked with white paint and the letters "B. M."; elevation, 13.96 feet above the gage datum. The reference point is the center of pulley of gage; elevation, 17.12 feet above the gage datum.

Discharge measurements of Wisconsin River near Rhinelander in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 27	M. S. Brennan	209	473	2.71	[a] 1,040
April 17	Horton and Brennan	215	822	4.25	2,580
June 12	M. S. Brennan	216	656	3.60	2,050

[a] Narrow strip of ice along shore.

Daily gage height, in feet, of Wisconsin River near Rhinelander, Wis., for 1905–6.

Day.	1905.	1906.											
	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.5	3.0	2.6	2.8	2.8	3.4	3.1	4.1	2.8	3.1	2.4	2.95	3.1
2	2.4	3.0	2.6	2.5	3.0	3.3	3.2	3.1	2.7	2.4	2.5	3.1	2.65
3	2.25	2.75	3.0	2.95	3.0	3.3	2.8	4.0	3.1	3.0	2.5	3.0	3.0
4	2.4	2.9	2.7	2.95	2.95	3.9	3.1	3.6	3.15	2.9	2.5	2.1	3.1
5	3.0	2.75	2.8	2.4	3.0	3.9	3.2	2.1	1.4	3.3	2.8	2.9	2.8
6	3.1	2.75	2.9	2.9	2.8	4.2	3.6	3.1	3.1	2.6	2.8	3.1	2.3
7	3.05	2.6	3.1	2.8	3.0	3.4	4.3	3.3	2.9	2.5	1.8	2.9	3.0
8	3.1	3.0	2.9	2.4	3.3	3.5	3.9	2.5	3.0	2.8	2.9	2.9	2.65
9	3.2	2.8	2.9	2.7	3.1	3.6	4.3	2.7	3.0	1.7	3.0	2.8	2.9
10	3.0	2.7	2.55	2.8	3.2	3.4	4.4	2.8	2.8	2.1	3.0	2.5	2.7
11	3.0	2.9	2.6	2.6	3.9	3.5	3.5	3.0	2.5	2.5	2.8	2.1	2.9
12	3.2	2.8	2.1	2.6	4.3	3.6	3.6	3.15	2.7	2.7	2.9	2.4	2.7
13	3.1	2.7	2.8	3.0	4.0	3.3	3.5	2.5	2.9	2.6	2.9	2.9	2.85
14	3.2	2.5	2.7	2.95	4.2	3.2	3.4	2.8	2.9	2.4	2.2	2.4	2.8
15	3.0	2.7	2.6	3.0	4.3	2.6	3.2	2.6	2.9	2.8	2.5	2.6	2.8
16	3.05	2.7	2.65	2.7	3.8	3.1	3.2	2.85	2.8	2.0	2.8	2.45	2.6
17	2.85	2.9	2.7	2.75	4.4	3.2	2.8	2.8	2.8	2.4	3.15	2.5	2.7
18	2.9	2.7	2.7	2.5	4.1	3.3	2.4	2.8	2.7	2.5	3.0	1.8	2.3
19	3.1	2.8	2.4	2.7	4.5	3.3	3.0	2.85	1.8	2.5	3.0	2.4	2.9
20	3.1	2.75	2.4	2.8	4.6	3.1	3.1	2.8	2.7	2.5	3.1	2.8	2.5
21	2.7	2.8	2.45	2.8	4.4	3.2	3.2	2.3	2.7	2.7	2.9	2.3	2.7
22	2.95	2.75	2.5	2.7	4.7	3.1	3.5	2.0	2.9	2.6	2.6	2.2	2.7
23	3.3	2.75	2.4	2.5	4.0	3.1	3.3	2.2	3.0	1.8	3.0	2.1	2.5
24	2.9	2.9	3.2	2.7	3.9	3.0	2.5	2.9	3.6	2.3	2.9	2.2	2.5
25	3.0	2.8	2.7	2.9	3.6	2.95	3.1	3.0	3.1	2.4	3.0	1.4	2.9
26	2.7	2.8	2.9	3.0	3.5	3.2	3.2	3.1	2.5	2.45	3.1	2.4	2.6
27	2.9	2.75	2.9	2.95	3.5	1.8	3.7	2.9	2.8	2.4	3.1	2.8	2.3
28	2.7	2.6	3.0	2.8	3.4	3.1	3.1	3.0	3.2	2.4	3.1	3.0	2.8
29	2.6	2.9	.....	2.5	3.9	3.05	3.7	2.0	3.25	2.6	3.1	3.2	2.8
30	2.8	3.0	.....	2.3	3.6	3.6	3.7	2.9	3.0	2.6	3.1	3.1	2.2
31	2.6	2.7	.....	2.7	.....	3.7	.....	2.6	2.9	.....	3.0	.....	2.7

NOTE.—No ice record.

WISCONSIN RIVER AT MERRILL, WIS.

This station was established November 17, 1902. It is located on the highway bridge in the city of Merrill, three blocks from the Lincoln County court-house, one-half mile from the Chicago, Milwaukee and St. Paul Railway station, and 1,000 feet below the dam of the electric-power house. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 68, where are given also references to publications that contain data for previous years.

Discharge measurements of Wisconsin River at Merrill, Wis., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 24[a]	M. S. Brennan	331	1,090	5.92	1,980
April 23[b]	do	334	2,300	8.26	10,000

[a] Partly frozen; discharge about 50 per cent of open channel rating. [b] Logs running.

Daily gage height, in feet, of Wisconsin River, at Merrill, Wis., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.6	5.5	5.75	5.65	7.35	6.55	6.65	4.45	5.85	3.5	6.05	5.9
2	5.75	5.9	5.7	5.7	7.65	6.65	6.45	4.6	6.45	4.5	5.7	5.8
3	6.45	5.5	5.45	6.15	7.8	6.45	7.0	5.2	6.4	4.8	6.0	5.6
4	6.3	5.9	5.2	6.7	7.6	5.85	7.2	5.3	6.35	5.0	5.95	5.5
5	6.85	5.6	5.75	7.65	7.75	7.35	6.85	5.45	6.15	4.75	5.0	5.7
6	5.95	5.65	6.0	7.45	7.75	8.15	6.55	5.05	5.9	5.05	5.75	5.6
7	5.8	5.5	5.65	7.6	7.3	8.25	6.95	5.05	5.6	4.85	5.45	5.45
8	5.7	5.8	5.9	7.5	6.8	7.95	7.5	5.1	5.3	4.45	5.85	5.3
9	5.5	5.6	5.8	8.0	6.45	8.1	5.7	5.15	5.0	4.75	5.65	5.3
10	5.55	5.9	5.4	9.75	6.75	7.75	5.75	5.6	5.0	4.15	5.25	4.8
11	6.05	5.8	4.95	9.8	6.95	7.5	5.7	5.5	4.8	5.3	5.35	5.5
12	5.95	5.65	6.0	9.75	7.0	7.5	5.8	5.9	4.7	5.25	4.9	5.4
13	5.75	5.65	5.6	10.0	6.6	6.7	5.65	4.8	5.55	5.3	5.2	5.7
14	5.8	5.55	6.15	10.05	6.65	6.4	5.8	5.2	5.6	5.0	5.0	5.0
15	5.65	5.7	5.8	9.95	6.65	6.1	5.5	5.05	5.65	4.35	5.65	5.45
16	5.95	5.25	5.9	9.45	6.7	6.1	4.55	5.6	5.7	4.85	5.3	5.45
17	6.35	5.05	6.05	9.2	6.95	5.7	5.6	5.15	3.75	5.15	5.45	5.4
18	6.15	5.1	5.75	9.25	6.4	5.55	5.25	5.2	5.05	5.3	5.15	5.55
19	5.65	5.2	5.6	9.5	6.55	5.85	5.25	5.05	5.45	5.95	5.45	5.5
20	5.65	5.3	5.6	9.55	6.8	6.4	5.15	3.3	5.4	5.1	5.55	5.1
21	5.9	5.75	5.9	9.4	7.2	6.65	5.05	5.6	5.4	5.9	5.75	5.4
22	5.75	5.85	5.75	9,15	6.95	5.8	4.15	6.55	5.75	5.6	5.7	4.95
23	6.0	5.8	5.8	8.85	6.6	5.75	3.5	7.55	5.5	5.6	5.25	5.0
24	5.6	5.65	5.85	8.25	6.55	6.15	5.5	7.15	4.45	5.85	5.1	4.85
25	5.2	5.95	5.6	8.25	6.95	6.7	5.55	6.8	5.55	6.95	5.45	5.35
26	5.5	5.7	5.95	8.0	7.05	6.2	5.15	8.45	5.1	6.65	5.4	5.4
27	5.9	5.5	6.15	7.55	6.4	6.1	4.35	7.75	5.35	6.5	5.5	5.6
28	5.6	5.95	5.7	7.3	6.8	6.05	4.95	7.25	5.0	6.15	6.1	5.7
29	5.7	.....	5.35	6.95	6.55	5.9	5.15	7.1	5.15	6.0	6.3	5.5
30	5.55	.....	5.8	7.4	7.2	6.45	3.8	5.95	4.7	6.1	6.3	5.65
31	5.85	.....	5.65	.....	6.95	.....	5.0	5.45	.....	6.1	.....	4.8

NOTE.—No ice record by observer. Probably ice conditions during January to March and December.

Rating table for Wisconsin River at Merrill, Wis., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.50	790	4.80	1,950	6.10	4,210	7.80	8,480
3.60	840	4.90	2,090	6.20	4,420	8.00	9,070
3.70	895	5.00	2,230	6.30	4,640	8.20	9,680
3.80	955	5.10	2,380	6.40	4,860	8.40	10,310
3.90	1,020	5.20	2,540	6.50	5,090	8.60	10,960
4.00	1,090	5.30	2,700	6.60	5,320	8.80	11,620
4.10	1,170	5.40	2,870	6.70	5,560	9.00	12,300
4.20	1,260	5.50	3,040	6.80	5,800	9.20	12,980
4.30	1,360	5.60	3,220	6.90	6,050	9.40	13,680
4.40	1,460	5.70	3,410	7.00	6,300	9.60	14,380
4.50	1,570	5.80	3,600	7.20	6,820	9.80	15,080
4.60	1,690	5.90	3,800	7.40	7,360	10.00	15,800
4.70	1,820	6.00	4,000	7.60	7,910		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906. It is fairly well defined between gage heights 5 feet and 8.5 feet. Below gage height 4.5 feet it is only approximate.

Monthly discharge of Wisconsin River at Merrill, Wis., for 1905–6.

[Drainage area, 2,630 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
1905.					
April	13,000	2,960	7,170	2.73	3.05
May	8,480	2,460	5,640	2.14	2.47
June	18,000	3,040	9,920	3.77	4.21
July	9,680	1,360	5,290	2.01	2.32
August	5,920	1,950	4,090	1.56	1.80
September	7,220	3,900	5,010	1.91	2.13
October	5,920	1,360	4,410	1.68	1.94
November	4,640	1,950	3,150	1.20	1.34
1906.					
April	16,000	3,320	10,400	3.95	4.41
May	8,480	4,860	6,230	2.37	2.73
June	9,840	3,130	5,510	2.09	2.33
July	7,630	790	3,450	1.31	1.51
August	10,500	700	3,770	1.43	1.65
September	4,980	925	2,950	1.12	1.25
October	6,180	790	2,900	1.10	1.27
November	4,640	2,090	3,170	1.21	1.35

NOTE.—Gage heights for 1905 are published in Water-Supply Paper No. 171. Discharge values for 1905 and 1906 are excellent, although logging may affect the results to a slight degree. Ice conditions assumed January, February, March, and December. Discharge as given by the measurements on January 24, 1906, is about 50 per cent of the open-channel rating.

WISCONSIN RIVER NEAR NECEDAH, WIS.

This station was established December 2, 1902. It is located on the highway toll bridge 3 miles east of Necedah, Wis., and 3 miles from the Chicago, Milwaukee and St. Paul and the Chicago and Northwestern railway stations. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 70, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of Wisconsin River near Necedah, Wis., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	8.5	7.6	8.0	8.2	4.8	6.7	4.8	6.65	8.5
2	.....	9.85	7.7	7.8	7.65	4.8	6.8	5.2	6.4	7.9
3	.....	9.5	7.65	7.5	7.4	4.8	5.9	4.8	6.7	7.0
4	.....	9.8	7.5	7.4	7.85	4.9	6.0	4.6	6.7	7.1
5	6.5	10.2	7.6	7.2	8.0	4.9	6.2	4.8	6.2	7.1
6	6.7	10.4	7.7	6.4	7.8	4.7	6.45	4.9	6.1	6.6
7	6.5	11.6	7.7	6.0	7.2	5.3	6.25	4.85	6.0	6.5
8	6.5	13.0	7.85	7.4	6.75	4.9	6.1	4.4	5.55	6.5
9	6.5	13.0	7.5	8.45	6.4	5.05	5.9	4.85	5.4	6.5
10	6.5	12.9	7.35	8.75	6.35	4.8	5.3	4.9	5.1	6.1
11	6.4	13.0	7.1	8.6	6.3	4.95	5.8	4.75	5.75	6.6
12	6.4	13.2	7.0	8.4	6.0	5.0	5.2	4.8	5.9	6.7
13	6.4	13.0	6.9	7.8	6.0	5.0	4.9	4.6	5.9	6.2
14	6.4	12.85	6.75	7.4	5.8	5.3	4.9	5.1	5.3	5.9
15	6.4	13.0	7.5	6.9	5.6	5.0	4.95	4.75	5.3	5.85
16	6.4	13.3	8.1	6.8	5.5	4.95	4.9	5.15	5.3	6.0
17	6.4	13.3	7.85	6.7	5.1	5.0	5.15	5.0	5.2	6.4
18	6.4	12.9	7.8	6.3	5.3	5.05	5.7	4.8	5.2	7.6
19	6.3	12.1	7.25	6.4	5.3	4.8	5.2	4.65	5.7	7.6
20	6.3	11.3	7.2	5.9	5.3	4.7	4.9	4.8	6.4	.....
21	6.4	11.0	6.85	6.3	5.35	5.1	5.0	5.1	6.35	.....
22	6.4	10.8	6.7	6.8	5.35	4.8	5.25	5.55	6.35	.....
23	5.7	10.6	6.6	8.1	5.2	4.9	5.3	6.0	5.7	.....
24	5.7	10.1	6.2	8.3	5.05	5.95	5.2	5.75	5.4	.....
25	6.2	9.6	6.4	7.7	5.1	6.7	5.6	5.75	5.6	.....
26	6.5	9.15	6.4	7.3	5.05	6.9	5.45	6.0	5.6	.....
27	6.7	8.75	6.4	7.7	5.0	6.7	5.3	7.0	6.5	.....
28	7.1	8.4	7.2	8.3	5.2	7.3	5.15	7.1	7.1	.....
29	7.1	8.2	8.75	8.4	4.5	7.9	5.2	6.9	8.0	.....
30	7.9	7.9	8.7	8.6	5.1	7.5	5.15	7.0	8.9	.....
31	7.9	.....	8.5	.....	4.6	7.15	.....	6.6	.....	.....

NOTE.—Ice conditions January 1 to April 2, approximately. During March ice 1.6 feet thick. Ice conditions from about December 17 to 31.

Rating table for Wisconsin River near Necedah, Wis., for 1904–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.50	2,810	5.60	5,380	6.60	8,200	8.20	13,000
4.60	3,020	5.70	5,640	6.70	8,500	8.40	13,600
4.70	3,240	5.80	5,900	6.80	8,800	8.60	14,200
4.80	3,460	5.90	6,170	6.90	9,100	8.80	14,800
4.90	3,690	6.00	6,440	7.00	9,400	9.00	15,400
5.00	3,920	6.10	6,720	7.20	10,000	9.20	16,000
5.10	4,150	6.20	7,010	7.40	10,600	9.40	16,600
5.20	4,390	6.30	7,300	7.60	11,200	9.60	17,200
5.30	4,630	6.40	7,600	7.80	11,800	9.80	17,800
5.40	4,880	6.50	7,900	8.00	12,400	10.00	18,400
5.50	5,130						

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904 and 1905. It is well defined between gage heights 4.5 feet and 10.5 feet. From gage height 6.3 feet to 11 feet the rating curve is a tangent, the difference being 300 per tenth. Above 11 feet the bank overflows, causing the discharge to increase at a greater rate per foot rise of gage.

Monthly discharge of Wisconsin River near Necedah, Wis., for 1906.

[Drainage area, 5,800 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
April	35,400	12,100	22,600	3.90	4.35
May	14,600	7,010	10,500	1.81	2.09
June	14,600	6,170	10,800	1.86	2.08
July	13,000	2,810	6,570	1.13	1.30
August	12,100	3,240	5,240	.903	1.04
September	8,800	3,690	5,140	.886	.99
October	9,700	2,600	4,840	.834	.96
November	15,100	4,150	6,760	1.17	1.30
December (1-19)[a]	13,900	6,040	8,160	1.41	1.00

[a] Discharge values December 17 to 19 corrected for ice conditions.

NOTE.—Values for 1906 good.

WAPSIPINICON RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Wapsipinicon River rises in Mower County, Minn., and flows southeastward, entering the Mississippi near Shafton, Scott County, Iowa. Its total drainage area is 2,300 square miles.

The river is generally fairly constant in flow, though its headwaters are sometimes low. As a rule, its banks are moderately high and the stream is well confined. There are numerous small power sites on this stream at Toronto, Oxford Mills, Newport, Anamosa, Central City, Troy Mills, Quasqueton, Independence, and Littleton. At several of these points, notably at Anamosa, there are good opportunities for building dams.

WAPSIPINICON RIVER AT STONE CITY, IOWA.

This station was established August 19, 1903. It is located in Stone City at the highway bridge, just above the Chicago, Milwaukee and St. Paul Railway bridge, and near the Dearborn stone quarry. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 73, where are given also references to publications that contain data for previous years.

Discharge measurements of Wapsipinicon River at Stone City, Iowa, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 12	M. S. Brennan	125	173	2.68	[a] 95
March 7	A. H. Horton	186	1,490	10.26	4,750
March 31	M. S. Brennan	189	2,200	13.64	9,340
April 2	do	181	1,430	9.88	4,580

[a] Stream frozen entirely across; thickness of ice, 0.9 foot. The discharge was about 60 per cent of the open-channel rating for gage height, 2.68 feet.

Daily gage height, in feet, of Wapsipinicon River at Stone City, Iowa, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	.....	9.42	12.45	3.62	3.95	2.95	2.90	2.72	3.08	2.68
2	.....	.....	10.02	10.00	3.60	4.32	2.92	2.90	2.68	3.02	2.80
3	2.76	.....	11.60	8.70	3.56	5.02	3.02	2.82	2.65	3.00	2.78
4	.....	.....	11.92	7.75	3.55	5.44	3.12	2.85	2.61	2.92	2.80
5	.....	.....	10.80	7.42	3.55	5.30	3.35	2.82	2.60	2.85	2.78
6	.....	.....	10.10	6.98	3.52	4.80	3.42	3.12	2.64	2.84	2.80
7	.....	3.04	9.30	6.85	3.50	4.35	3.40	3.04	2.62	2.80	2.76
8	.....	.....	8.80	6.70	3.48	3.92	3.30	3.00	2.62	2.78	2.74
9	2.68	.....	8.50	7.45	3.58	3.73	3.22	3.26	2.62	2.74	2.72
10	.....	.....	8.15	7.92	3.60	3.50	3.15	3.26	2.63	2.72	2.70
11	.....	.....	7.50	8.20	3.58	3.48	3.12	3.40	2.62	2.68	2.68
12	2.68	.....	7.10	8.20	3.52	3.34	3.10	3.68	2.72	2.65	2.66
13	.....	.....	6.35	7.88	3.48	3.25	3.35	3.68	2.82	2.68	2.65
14	.....	3.26	5.45	7.20	3.44	3.25	3.08	3.56	2.72	2.64	2.65
15	.....	.....	5.50	6.54	3.40	3.28	3.00	3.42	2.71	2.64	2.74
16	.....	.....	5.60	6.40	3.36	3.40	2.94	3.40	2.70	2.62	2.74
17	3.02	.....	5.45	6.23	3.38	3.35	2.90	3.35	2.75	2.62	2.75
18	.....	.....	4.95	5.90	3.52	3.24	2.85	3.22	2.76	2.62	2.72
19	.....	3.35	4.72	5.62	3.35	.....	2.82	3.12	2.85	2.62	2.70
20	.....	3.80	4.64	5.38	3.32	3.10	2.74	3.05	2.96	2.58	2.68
21	.....	5.05	4.30	5.05	3.25	3.10	2.80	3.00	2.95	2.56	2.70
22	.....	6.12	4.16	4.78	3.30	3.10	2.90	2.94	3.15	2.61	2.62
23	3.75	7.44	3.92	4.55	3.60	3.06	2.88	2.91	3.32	2.60	2.54
24	.....	7.95	3.80	4.38	4.02	3.02	2.81	2.85	3.52	2.64	2.52
25	.....	8.40	3.84	4.12	4.30	3.04	2.80	2.90	3.55	2.62	2.68
26	.....	8.55	4.45	3.96	4.30	2.92	2.72	2.96	3.54	2.60	2.96
27	.....	8.95	6.09	3.85	4.02	2.98	2.76	2.92	3.42	2.62	2.92
28	.....	9.55	7.42	3.72	3.95	2.96	2.78	2.88	3.30	2.64	3.12
29	.....	.....	8.90	3.65	4.02	2.94	2.88	2.84	3.22	2.64	3.08
30	.....	.....	10.82	3.60	3.84	2.98	2.96	2.80	3.15	2.65	3.08
31	3.16	.....	13.66	.....	3.75	.....	2.92	2.79	.....	2.66	.....

NOTE.—River frozen January 1 to March 2; thickness of ice increasd from 0.5 foot January 3 to 1.3 feet February 14. River also frozen November 23 to 27 and December 7 to 31. During December the thickness of the ice was about 0.3 foot.

Rating table for Wapsipinicon River at Stone City, Iowa, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.50	115	3.70	570	4.90	1,185	7.20	2,580
2.60	137	3.80	620	5.00	1,240	7.40	2,710
2.70	162	3.90	670	5.20	1,350	7.60	2,840
2.80	189	4.00	720	5.40	1,460	7.80	2,980
2.90	218	4.10	770	5.60	1,580	8.00	3,120
3.00	250	4.20	820	5.80	1,700	9.00	3,850
3.10	286	4.30	870	6.00	1,820	10.00	4,640
3.20	326	4.40	920	6.20	1,940	11.00	5,520
3.30	370	4.50	970	6.40	2,060	12.00	6,560
3.40	420	4.60	1,020	6.60	2,190	13.00	7,770
3.50	470	4.70	1,075	6.80	2,320	14.00	9,160
3.60	520	4.80	1,130	7.00	2,450		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904-1906. It is well defined above gage height 2.7 feet.

Monthly discharge of Wapsipinicon River at Stone City, Iowa, for 1906.

[Drainage area, 1,310 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
March	8,690	620	2,890	2.21	2.55
April	7,100	520	2,170	1.66	1.85
May	870	348	531	.405	.47
June	1,480	224	523	.399	.45
July	430	167	258	.197	.23
August	560	186	293	.224	.26
September	495	137	236	.180	.20
October	279	128	166	.127	.15
November	294	119	189	.137	.15

NOTE.—Values for 1906 are excellent. During the winter period the minimum flow was probably at least as low as 40 second-feet.

ROCK RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Rock River rises in the southeastern part of Wisconsin, flows south and southwest, and enters the Mississippi just below Rock Island, Ill. Its length is 286 miles. Of the total drainage area (11,000 square miles), 5,650 square miles are in Wisconsin and 5,350 in Illinois. The length of the basin is 175 miles; its greatest width is near the Wisconsin-Illinois State line, where for 20 miles or more it averages about 80 miles; above the boundary it averages 40 or 50 miles in width, while below, in Illinois, it narrows rapidly.

In the upper part of its course the river flows rather toward the eastern side of the basin, but near the State line it approaches the center, and finally flows decidedly near the western boundary of its drainage area. The total fall of the stream, distributed with comparative uniformity throughout its length, is 340 feet, an average of 1.2 feet per mile.

The country drained is undulating and comprises large expanses of unbroken prairie, groves, and extensive bodies of timber, swamp, and lake.

The data collected in this basin are valuable for water-power purposes.

ROCK RIVER AT ROCKTON, ILL.

This station was established May 13, 1903. It is located at the Rockton highway bridge, one-half mile from the Chicago, Milwaukee and St. Paul Railway station, 1 mile below the dam, and three-fourths mile below the junction of Pecatonica River with Rock River. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 76, where are given also references to publications that contain data for previous years.

Discharge measurements of Rock River at Rockton, Ill., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 31	M. S. Brennan	503	2,390	5.79	8,240
February 24	do	510	4,300	9.85	16,000
February 25	do	510	4,740	10.55	18,600
February 27	do	510	4,130	9.36	15,400
February 27	do	510	4,180	9.45	16,500
February 28	do	510	4,000	9.13	14,900
May 3	do	494	1,420	4.10	4,570

NOTE.—Measurements January 31 to February 28, inclusive, were slightly affected by ice conditions below the gaging section.

Daily gage height, in feet, of Rock River at Rockton, Ill., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Oct.	Nov.	Dec.
1	3.3	5.45	8.8	8.7	4.15	3.15	3.3	1.1	1.5	3.25
2	2.95	5.0	8.8	8.45	4.15	3.0	3.2	1.4	1.6	3.0
3	2.85	5.72	11.15	7.95	4.1	2.8	3.15	1.3	1.4	2.85
4	3.9	5.45	10.8	7.0	4.1	2.45	3.05	1.2	1.5	2.7
5	4.57	6.75	10.0	6.25	4.0	2.8	3.0	1.1	1.45	2.6
6	4.9	6.9	10.25	6.15	3.9	2.8	2.9	1.05	1.55	2.9
7	4.9	5.75	9.85	6.1	3.95	2.8	2.85	1.4	1.55	2.65
8	5.6	7.15	9.45	6.15	3.85	2.8	2.7	1.15	1.5	2.25
9	6.25	6.5	9.25	6.65	3.8	2.6	2.7	1.1	1.4	2.4
10	6.0	5.45	8.75	7.0	3.7	2.6	2.6	1.0	1.4	2.4
11	4.85	5.75	8.4	7.0	3.6	2.55	2.6	1.1	1.4	2.35
12	4.0	5.7	6.8	6.45	3.6	2.7	2.5	1.1	1.35	2.35
13	3.5	4.7	6.05	6.8	3.4	2.6	2.4	1.1	1.45	2.3
14	3.1	4.7	6.2	6.4	3.5	2.5	2.45	1.1	1.4	2.3
15	3.4	5.88	6.2	6.15	3.5	2.5	2.5	1.0	1.4	2.3
16	8.4	5.7	6.0	6.25	3.45	2.5	2.45	.95	1.3	2.0
17	7.25	5.45	6.25	6.05	3.2	2.3	2.5	1.0	1.15	2.0
18	7.1	5.1	5.61	5.9	3.15	2.3	2.4	1.0	1.3	2.0
19	7.3	4.3	5.31	5.75	3.0	2.45	2.3	.95	1.1	2.15
20	7.3	5.0	5.0	5.6	2.95	2.35	2.4	1.0	1.3	2.2
21	9.62	9.4	4.75	5.4	3.05	2.7	.....	1.25	1.3	2.0
22	9.5	9.1	4.3	5.35	2.9	2.6	.....	1.25	1.75	2.0
23	7.85	8.83	4.5	5.25	2.9	2.7	.....	1.3	1.95	2.0
24	8.7	9.25	4.4	5.0	2.9	2.65	.....	1.25	1.75	2.0
25	9.3	10.7	4.4	4.8	2.85	2.6	.....	1.3	1.8	1.5
26	9.5	9.85	4.65	4.7	2.9	2.75	.....	1.35	2.4	2.5
27	9.15	9.4	8.21	4.55	3.1	2.6	.....	1.4	3.4	1.5
28	8.3	9.25	8.3	4.53	3.4	2.5	.....	1.5	3.9	1.5
29	7.8	.....	8.7	4.5	3.2	3.1	.....	1.6	3.85	1.65
30	7.1	.....	8.8	4.21	3.6	3.3	.....	1.6	3.65	1.45
31	6.05	.....	8.75	.....	3.5	.....	.....	1.7	.....	3.01

NOTE.—Ice conditions January 5 to 10 and February 8 to 20; slight ice conditions during December. Gage heights are to water surface. This station was temporarily discontinued from July 21 to September 30.

Rating table for Rock River at Rockton, Ill., for 1904–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	500	2.10	1,470	3.20	3,105	4.60	5,760
1.10	560	2.20	1,600	3.30	3,280	4.80	6,180
1.20	624	2.30	1,740	3.40	3,455	5.00	6,620
1.30	692	2.40	1,880	3.50	3,635	5.20	7,070
1.40	764	2.50	2,025	3.60	3,815	5.40	7,540
1.50	840	2.60	2,170	3.70	3,995	5.60	8,020
1.60	925	2.70	2,320	3.80	4,180	5.80	8,520
1.70	1,020	2.80	2,470	3.90	4,365	6.00	9,020
1.80	1,122	2.90	2,620	4.00	4,555	7.00	11,520
1.90	1,234	3.00	2,775	4.20	4,940	9.00	16,520
2.00	1,350	3.10	2,935	4.40	5,345	11.00	21,520

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906. It is well defined between gage heights 2.4 feet and 6 feet. The table has been extended beyond these limits, being based on one measurement at 13.32 feet. Above gage height 5.6 feet the rating curve is a tangent, the difference being 250 per tenth. Below gage height 2 feet the rating is approximate.

Monthly discharge of Rock River at Rockton, Ill., for 1906.

[Drainage area, 6,150 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	18,100	2,540	9,620	1.56	1.80
February	19,000	4,000	9,760	1.59	1.69
March	20,300	5,140	11,800	1.92	2.21
April	15,800	4,900	9,160	1.49	1.66
May	4,840	2,540	3,590	.584	.67
June	3,280	1,740	2,280	.371	.41
July 1-20	3,280	1,740	2,330	.379	.28
October	1,020	472	641	.104	.12
November	4,360	560	1,280	.208	.23
December	3,190	802	1,740	.283	.33

NOTE.—Values are rated as follows: January and March, good; February and October, approximate; April to July, excellent; November and December, fair. Discharge for ice periods corrected.

ROCK RIVER NEAR NELSON, ILL.

This station was established June 8 and was discontinued July 21, 1906. It is located about 1¼ miles west of Nelson, Ill., at the Chicago and Northwestern Railway bridge.

The channel is straight for 1,000 feet above and below the station. The right bank is high and does not overflow; the left bank is low and overflows. All of the discharge passes the section. The bed of the river is rocky and permanent, and the current is of moderate swiftness. The remains of old piers and an island above the station may affect the flow.

Discharge measurements were made from the downstream side of the five-span railway bridge to which the gage is attached. The initial point for soundings is the center of the right floor beam, which rests upon the right abutment.

The standard chain gage, which was read once each day by John McGlaughlin, is located on the lower side of the bridge about the center of the second span from the left side. Length of chain, 31.28 feet.

The bench mark is the top of the downstream end of the floor beam 363 feet from the right end of bridge; elevation, 30 feet above the gage datum.

Discharge measurements of Rock River near Nelson, Ill., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 4	M. S. Brennan	621	3,020	6.19	5,380
June 5	A. H. Horton	602	2,260	5.02	2,720
June 30	do	615	2,920	6.12	5,190

Daily gage height, in feet, of Rock River near Nelson, Ill., for 1906.

Day.	June.	July.	Day.	June.	July.
1		6.2	16	4.7	4.7
2		5.6	17	4.65	4.6
3		5.6	18	4.55	4.7
4		5.5	19	4.35	4.5
5		5.6	20	4.85	4.5
6		5.3	21	5.0	4.6
7		5.2	22	5.0	
8	5.2	5.1	23	4.8	
9	5.05	5.0	24	4.85	
10	5.0	4.8	25	4.7	
11	4.75	4.9	26	4.8	
12	4.65	4.9	27	4.85	
13	4.85	4.7	28	8.0	
14	4.9	4.7	29	6.4	
15	4.8	4.7	30	6.15	

ROCK RIVER AT STERLING, ILL.

This station was established January 5, 1905, and was discontinued March 3, 1906, on account of an ice gorge destroying the bridge. It was located on the new highway bridge in Sterling, Ill., about one-half mile below the dam of the Sterling Manufacturing Company. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 78, where are given also references to publications that contain data for previous years.

Discharge measurements of Rock River at Sterling, Ill., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 16[a]	M. S. Brennan	553	1,780	7.40	[c] 3,370
January 16[b]	do	282	1,220	8.20	[c] 2,300

[a] North channel. [b] South channel. [c] Ice conditions.

Daily gage height, in feet, of Rock River, at Sterling, Ill., for 1906.

Day.	North channel.		South channel.		Day.	North channel.		South channel.	
	Jan.	Feb.	Jan.	Feb.		Jan.	Feb.	Jan.	Feb.
1	6.04	14.71	5.88	15.72	17	7.00	13.10	7.04	14.90
2	6.06	14.64	5.90	15.64	18	6.98		7.02	
3	6.12	14.65	5.95	15.64	19	6.98		7.06	
4	6.12		5.98		20	7.00		7.10	
5	6.12		6.00		21	9.20		9.32	
6	6.16		6.06		22	[a] 11.84		[a] 11.94	
7	6.38		6.22		23	13.26		13.52	
8	6.46		6.29		24	14.38		14.78	
9	6.52		6.36		25	15.2		16.30	
10	6.58	13.00	6.40	14.10	26	15.45		16.50	
11	6.63		6.46		27	15.52		16.50	
12	6.77		6.66		28	15.3		16.52	
13	6.82		6.70		29	15.19		16.26	
14	6.88		6.77		30	14.78		15.66	
15	6.98		7.04		31	14.98		15.69	
16	6.98		7.04						

[a] Ice conditions January and February; both channels gorged with ice January 22 to February 26; South Channel bridge carried away February 22; North Channel bridge carried away February 25.

IOWA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Iowa River rises in north-central Iowa, flows in a southeasterly direction, and joins the Mississippi about 30 miles above Burlington. Its chief tributary is Cedar River, which rises in Minnesota and flows into the Iowa about 50 miles above the mouth of the latter. The total drainage area of the Iowa is 12,400 square miles, 4,470 square miles of this being tributary to it above its junction with Cedar River at Columbus Junction. Cedar River drains 7,600 square miles above its union with Iowa River.

The chief power plants in the Iowa basin are at Iowa City, Marshalltown, Cedar Rapids, Waterloo, and Cedar Falls. The data collected in this basin are valuable for water-power purposes.

IOWA RIVER AT IOWA CITY, IOWA.

This station was established June 1, 1903, and was discontinued July 21, 1906. It is located on the county bridge directly west of the university grounds. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 83, where are given also references to publications that contain data for previous years.

A measurement was made at this station on June 1, 1906, by M. S. Brennan, giving the following results:

Width, 171 feet; area, 735 square feet; gage height, —0.35 foot; discharge, 470 feet.

At the time of this measurement there was ice along the shore. Therefore the discharge was about 70 per cent of the open-channel rating.

Daily gage height, in feet, of Iowa River at Iowa City, Iowa, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1			9.3	6.8	1.9		
2			9.9	7.2	1.9		1.1
3		2.2	8.3	7.6	2.0		.9
4			7.7	7.6	1.9	1.3	2.3
5			6.8	7.6	1.8	1.2	1.8
6			6.6	7.6	1.7	1.5	1.5
7			5.8	7.0	1.7	1.5	1.2
8			4.7	6.1	1.9	1.3	.8
9		1.2	4.4	6.2	1.9	1.2	.4
10			4.0	5.8	1.8	.9	.4
11			3.4	5.5	1.6	.8	.2
12			2.8	5.4		.6	.3
13	—0.1		2.4	5.0	1.3	.6	.5
14			2.0	4.7	1.1	.6	—.5
15			1.8	4.6	1.1	.5	.7
16			1.8	4.2	1.0	.5	.7
17		1.2	2.5	4.1	.9	.5	.7
18			2.4	4.2	.9	.3	1.0
19			1.8	4.3	.8	.5	.8
20			2.7	4.2	.6	.6	—.9

Daily gage height, in feet, of Iowa River at Iowa City, Iowa, for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
21	6.0	.....	2.3	4.0	0.6	.....	−0.8
22	.....	.....	2.1	3.7	1.3	1.1	.....
23	.....	.....	1.9	3.4	1.8	1.0	.....
24	.....	7.6	1.4	3.1	2.1	1.1	.....
25	.....	8.0	1.4	2.8	2.3	1.1	.....
26	.....	8.0	5.95	2.5	.....	1.0	.....
27	2.7	9.4	5.4	2.2	2.5	.9	.....
28	.....	9.6	4.5	2.1	1.7	.7	.....
29	.....	.....	5.3	1.9	1.8	.6	.....
30	.....	.....	6.2	1.8	1.7	1.0	.....
31	.....	.....	6.6	.....	1.7	.....	.....

NOTE.—River frozen, January 1 to February 23; January 13, ice 0.8 foot thick; January 21, rise caused by ice jam; January 27, open water within 2 feet of gage; February 3, open water within 4 feet of gage; February 9, small opening below gage; February 17, gage reading to top of ice; February 24 and 25, ice jam. After June 3 gage heights were affected slightly by the construction of a dam below the station.

Rating table for Iowa River at Iowa City, Iowa, for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
−1.00	360	0.30	916	1.60	1,760	3.80	3,650
−0.90	392	0.40	971	1.70	1,830	4.00	3,840
−0.80	426	0.50	1,028	1.80	1,900	4.20	4,030
−0.70	462	0.60	1,087	1.90	1,970	4.40	4,220
−0.60	499	0.70	1,148	2.00	2,040	4.60	4,410
−0.50	538	0.80	1,210	2.20	2,190	4.80	4,600
−0.40	579	0.90	1,274	2.40	2,350	5.00	4,800
−0.30	622	1.00	1,340	2.60	2,520	6.00	5,900
−0.20	666	1.10	1,410	2.80	2,700	7.00	7,150
−0.10	712	1.20	1,480	3.00	2,890	8.00	8,540
0.00	760	1.30	1,550	3.20	3,080	9.00	10,040
0.10	810	1.40	1,620	3.40	3,270	10.00	11,600
0.20	862	1.50	1,690	3.60	3,460		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1905. It is well defined above gage height −1 foot.

Monthly discharge of Iowa River at Iowa City, Iowa, for 1906.

[Drainage area, 3,320 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft per sq. mile.	Depth in inches.
March	11,400	1,620	4,420	1.33	1.53
April	7,900	1,900	4,750	1.43	1.60
May	2,440	1,090	1,760	.530	.61
June	1,760	916	1,310	.395	.44
July (1–21)	2,270	360	948	.286	.22

NOTE.—Values are rated as follows: March, June, and July, good; April and May, excellent. The minimum flow during ice period was at least as low as 470 second-feet.

CEDAR RIVER AT CEDAR RAPIDS, IOWA.

This station was established October 26, 1902. It is located at Cedar Rapids, Iowa, about 50 miles above the mouth of the river, and is near the city gas works and the plant of the Iowa Windmill and Pump Company. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 86, where are given also references to publications that contain data for previous years.

Discharge measurements of Cedar River at Cedar Rapids, Iowa, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 31	M. S. Brennan	658	6,550	11.82	32,900
March 31	do	658	6,060	11.05	29,900
April 1	do	653	4,390	8.60	20,200
April 1	do	658	4,740	9.15	22,200
April 2	do	651	3,740	7.60	15,700

Daily gage height, in feet, of Cedar River at Cedar Rapids, Iowa, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.0	3.35	8.25	8.2	4.15	5.55	3.75	3.5	3.35	4.05	3.75	4.15
2	2.9	3.55	7.4	7.1	4.15	5.3	3.7	3.45	3.3	4.0	3.65	4.15
3	2.85	3.6	7.55	6.3	4.15	4.95	3.8	3.4	3.3	3.9	3.65	4.05
4	2.85	3.55	7.5	6.05	4.3	4.7	3.7	3.35	3.25	3.85	3.6	4.1
5	2.9	3.5	7.4	5.8	4.5	4.5	3.8	3.3	3.55	3.75	3.6	4.05
6	2.9	3.45	7.2	5.6	4.45	4.35	4.05	3.3	3.65	3.75	3.6	4.0
7	3.0	3.55	6.65	5.55	4.4	4.25	3.85	3.7	3.7	3.6	3.55	3.95
8	3.2	3.65	6.3	5.55	4.35	4.2	3.75	3.85	3.65	3.55	3.55	3.15
9	3.15	3.5	5.8	5.75	4.2	4.2	3.6	4.4	3.6	3.45	3.5	3.45
10	2.8	3.45	5.6	5.8	4.1	4.2	3.55	4.3	3.55	3.45	3.45	3.35
11	2.8	3.45	5.4	5.7	4.05	4.15	3.45	4.6	3.45	3.45	3.5	3.4
12	2.75	3.4	5.2	5.65	4.0	4.05	3.45	4.95	3.4	3.4	3.6	3.45
13	2.85	3.35	4.3	5.8	3.95	3.95	3.45	4.9	3.35	3.4	3.55	3.6
14	3.0	3.35	4.15	5.65	3.95	3.9	3.45	4.65	3.3	3.3	3.55	3.85
15	3.15	3.3	4.25	5.45	3.9	3.85	3.4	4.4	3.3	3.25	3.55	4.45
16	3.15	3.3	4.4	5.55	3.85	3.75	3.35	4.25	3.2	3.3	3.55	4.7
17	3.25	3.3	4.35	5.75	4.0	3.7	3.4	4.05	3.3	3.3	3.55	4.2
18	3.2	3.45	4.3	5.9	5.05	3.65	3.4	4.0	3.35	3.3	3.55	4.35
19	3.15	3.5	4.25	5.85	5.85	3.75	3.35	3.85	3.5	3.25	3.55	4.05
20	3.0	4.3	4.25	5.55	6.35	3.65	3.35	3.85	4.4	3.3	3.55	3.9
21	3.9	4.5	4.2	5.3	5.9	3.55	3.4	3.8	4.6	3.25	3.6	3.95
22	4.5	4.6	4.2	5.2	5.45	3.6	3.45	3.65	4.55	3.25	3.65	4.65
23	3.8	5.55	4.15	4.8	5.1	3.65	3.55	3.65	4.5	3.2	3.5	4.5
24	3.5	5.45	4.2	4.65	4.75	3.8	.....	3.7	4.6	3.35	3.45	4.45
25	3.4	5.55	4.15	4.5	4.7	3.85	.....	3.65	4.75	3.35	3.5	4.45
26	3.4	5.85	5.1	4.4	4.5	3.75	.....	3.7	4.8	3.3	3.65	4.2
27	3.3	7.8	5.5	4.25	4.5	3.7	3.3	3.65	4.65	3.45	3.85	4.05
28	3.3	8.37	6.45	4.2	4.85	3.65	3.3	3.45	4.45	3.6	3.9	3.95
29	3.3	.....	10.29	4.15	4.95	3.6	3.25	3.4	4.25	3.8	3.9	3.8
30	3.25	.....	16.27	4.1	5.2	3.65	3.25	3.4	4.15	3.8	4.1	3.95
31	3.3	.....	12.1	.....	5.55	.....	3.3	3.35	.....	3.75	.....	4.25

NOTE.—River generally frozen over January 1 to March 15; open channel at gage during ice period; river frozen along shore December 17 to 31.

Rating table for Cedar River at Cedar Rapids, Iowa, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.70	600	3.80	2,575	4.90	6,150	6.00	10,000
2.80	720	3.90	2,875	5.00	6,500	6.20	10,750
2.90	840	4.00	3,175	5.10	6,850	6.40	11,510
3.00	970	4.10	3,475	5.20	7,200	6.60	12,280
3.10	1,110	4.20	3,800	5.30	7,550	6.80	13,060
3.20	1,270	4.30	4,125	5.40	7,900	7.00	13,850
3.30	1,440	4.40	4,450	5.50	8,250	8.00	17,800
3.40	1,625	4.50	4,775	5.60	8,600	10.00	25,700
3.50	1,825	4.60	5,100	5.70	8,950	12.00	33,600
3.60	2,050	4.70	5,450	5.80	9,300	14.00	41,500
3.70	2,300	4.80	5,800	5.90	9,650	16.00	49,400

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903-1906. It is well defined between gage heights 2.9 feet and 12 feet. Above gage height 7 feet the rating curve is a tangent, the difference being 395 per tenth.

Monthly discharge of Cedar River at Cedar Rapids, Iowa, for 1906.

[Drainage area, 6,320 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	4,780	660	1,350	0.214	0.25
February	19,300	1,440	4,200	.665	.69
March	50,500	3,640	11,000	1.74	2.01
April	18,600	3,480	8,210	1.30	1.45
May	11,300	2,720	5,240	.829	.96
June	8,420	1,940	3,400	.538	.60
July	3,320	1,360	1,880	.297	.34
August	6,320	1,440	2,860	.453	.52
September	5,800	1,270	5,810	.919	1.03
October	3,320	1,270	1,910	.302	.35
November	3,480	1,720	2,120	.335	.37
December	5,450	1,190	3,310	.524	.60
The year	50,500	660	4,270	.676	9.17

NOTE.—Discharge applied as for open channel during winter period, which may give somewhat excessive results. Values are rated as follows: January, February, and December, good; March to November, excellent.

RED CEDAR RIVER AT JANESVILLE, IOWA.

This station was established April 26, 1905, and was discontinued September 30, 1906. It is located on the Illinois Central Railroad bridge at Janesville, Iowa, about one-fourth mile below the highway bridge. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 86, where are given also references to publications that contain data for previous years.

Discharge measurements of Red Cedar River at Janesville, Iowa, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 11	M. S. Brennan	136	178	1.70	[a] 238
March 18	A. H. Horton	236	1,118	5.72	[b] 1,930
March 28	M. S. Brennan	229	2,570	12.12	17,500
March 29	do	229	2,150	10.26	11,200
March 29	do	229	1,980	9.51	9,370
March 29	do	229	1,860	9.01	8,310
March 30	do	229	1,430	7.14	5,350
March 30	do	229	1,510	7.46	5,730

[a] River frozen entirely across. Gage height to bottom of ice, 0.70 foot; ice, 1.2 feet thick. Discharge about 70 per cent less than the open-channel rating at gage height 1.70 feet.
[b] Ice gorge one-fourth mile below station reduced the discharge about 50 per cent.

Daily gage height, in feet, of Red Cedar River at Janesville, Iowa, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1			6.7	4.9	1.8	3.8	1.7	1.3	1.0
2				4.1	2.0	3.2	1.6	1.2	1.0
3		1.9	10.0	3.8	2.2	2.8	1.5	1.1	1.3
4			9.4	3.6	2.5	2.6	1.8	1.1	1.7
5	1.7		8.8	3.5	2.4	2.4	1.5	1.1	1.7
6			7.6	3.5	2.2	2.3	1.4	1.4	1.8
7			6.2	3.6	2.0	2.3	1.4	1.3	1.7
8			5.7	3.5	1.9	2.7	1.3	1.9	1.5
9			6.0	3.8	1.8	2.6	1.2	2.3	1.4
10		1.7	4.0	4.1	1.7	2.6	1.2	3.6	1.3

Daily gage height, in feet, of Red Cedar River at Janesville, Iowa, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
11	1.7	.....	.....	4.1	1.7	2.2	1.2	1.1	1.1
12	1.7	.....	6.1	4.0	1.7	2.0	1.1	2.7	1.2
13	.....	.....	6.1	3.7	1.6	1.9	1.2	2.4	1.1
14	.....	.....	6.2	3.8	1.6	1.8	1.2	2.0	1.0
15	.....	.....	5.7	5.1	1.6	1.7	1.2	1.7	1.0
16	.....	.....	5.5	5.6	4.5	1.6	1.2	1.6	1.0
17	.....	2.0	5.0	4.9	8.3	1.6	1.2	1.5	3.8
18	.....	.....	4.9	4.0	7.2	1.5	1.1	1.4	3.8
19	1.9	.....	4.6	3.4	5.6	1.5	1.1	1.4	4.5
20	.....	.....	4.0	3.0	4.0	1.5	1.1	1.3	3.5
21	.....	.....	4.1	2.8	3.3	1.5	[a] 1.1	1.2	3.1
22	.....	.....	3.6	2.6	2.7	1.4	1.1	1.2	2.9
23	.....	.....	3.6	2.5	2.4	1.4	1.1	1.2	4.5
24	.....	6.6	3.6	2.3	2.2	1.4	1.1	1.2	5.0
25	.....	8.3	2.4	2.2	2.3	1.3	1.1	1.2	4.5
26	.....	10.0	6.9	2.1	3.2	1.3	1.1	1.1	3.3
27	1.9	8.4	12.5	1.9	4.7	1.3	1.1	1.1	2.6
28	.....	8.1	13.3	2.0	6.1	1.3	1.1	1.1	2.2
29	.....	.....	10.1	1.9	6.3	2.0	1.5	1.1	2.0
30	.....	.....	7.2	1.8	6.0	1.5	1.7	1.0	1.8
31	.....	.....	6.0	.....	4.7	.....	1.4	1.0	.....

[a] Interpolated July 21 to 27.

NOTE.—Ice conditions January 1 to March 25: Thickness of ice January 12 to February 17, 1.3 feet. February 24 to March 1, ice broken up. March 3 to 9, river clear of floating ice but gorged below gage. March 12 to 21, river blocked with ice.

Rating table for Red Cedar River at Janesville, Iowa, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	380	2.40	1,300	3.80	2,340	6.40	4,560
1.10	440	2.50	1,370	3.90	2,420	6.60	4,760
1.20	500	2.60	1,440	4.00	2,500	6.80	4,970
1.30	560	2.70	1,510	4.20	2,660	7.00	5,190
1.40	620	2.80	1,580	4.40	2,820	7.20	5,420
1.50	680	2.90	1,650	4.60	2,980	7.40	5,660
1.60	740	3.00	1,720	4.80	3,140	7.60	5,910
1.70	810	3.10	1,790	5.00	3,300	7.80	6,180
1.80	880	3.20	1,860	5.20	3,470	8.00	6,500
1.90	950	3.30	1,940	5.40	3,640	9.00	8,270
2.00	1,020	3.40	2,020	5.60	3,820	10.00	10,500
2.10	1,090	3.50	2,100	5.80	4,000	11.00	13,500
2.20	1,160	3.60	2,180	6.00	4,180	12.00	17,000
2.30	1,230	3.70	2,260	6.20	4,370	13.00	21,100

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905–6. It is well defined between gage heights 1 foot and 12 feet.

Monthly discharge of Red Cedar River at Janesville, Iowa, for 1906.

[Drainage area, 1,840 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
March (26–31)	22,600	4,180	11,200	6.09	1.36
April	3,820	880	2,060	1.12	1.25
May	7,030	740	2,070	1.12	1.29
June	2,340	560	1,010	.549	.61
July	880	440	548	.298	.34
August	2,180	380	732	.398	.46
September	3,300	380	1,200	.652	.73

NOTE.—Values for 1906 are excellent. The flow during the winter period probably did not fall much below 240 second-feet.

DES MOINES RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Des Moines River rises in the southern part of Minnesota, flows to the south and southeast, and enters the Mississippi near Keokuk, Iowa. Its principal tributary is Raccoon River, which joins it at the city of Des Moines. The total drainage area of the Des Moines is 14,700 square miles. Above the mouth of the Raccoon its drainage area is 6,460 miles, while that of the Raccoon at its confluence with the Des Moines is 3,680 square miles.

The Des Moines is the largest stream in the State of Iowa and affords numerous opportunities for the development of water power. It is the natural recipient of the sewage of many towns.

DES MOINES RIVER AT FORT DODGE, IOWA.

This station was established April 22, 1905, and was discontinued July 19, 1906. It is located at the "Swede Town" bridge, the only highway bridge in Fort Dodge. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 90.

Discharge measurements of Des Moines River at Fort Dodge, Iowa, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 3	M. S. Brennan	272	1,240	5.25	3,550
May 23	do	249	694	3.31	1,130

Daily gage height, in feet, of Des Moines River at Fort Dodge, Iowa, for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Day.	Mar.	Apr.	May.	June.	July.
1		5.7	5.9	3.8	3.5	17		6.25	4.0	3.15	2.8
2		5.45	6.1	3.6	3.35	18		6.15	3.9	3.1	2.6
3		5.25	6.05	3.85	3.3	19		6.0	3.7	3.6	2.7
4		5.2	5.8	3.8	3.25	20		5.95	3.5	4.0	
5		5.15	5.5	3.8	3.2	21		5.5	3.45	4.0	
6		5.2	5.15	3.8	3.2	22		5.5	3.45	4.0	
7		5.3	4.85	3.7	3.1	23		5.4	3.35	3.85	
8		5.45	4.65	3.7	3.05	24		5.1	4.1	3.75	
9		5.7	4.45	3.6	2.95	25		4.9	3.8	3.7	
10		5.85	4.25	3.5	2.9	26	9.9	4.7	3.8	3.7	
11		5.85	4.15	3.45	2.9	27	7.75	4.5	3.75	3.8	
12		5.75	4.0	3.35	2.7	28	7.75	4.5	3.7	3.85	
13		6.05	3.9	3.3	2.7	29	6.8	4.35	3.7	3.7	
14		6.25	3.8	3.3	2.8	30	6.25	4.25	3.7	3.6	
15		6.4	4.35	3.25	2.85	31	5.8				
16		6.4	4.1	3.2	2.85						

NOTE.—Ice conditions January 1 to March 25.

Rating table for Des Moines River at Fort Dodge, Iowa, for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.60	550	3.70	1,450	4.80	2,835	5.90	4,555
2.70	615	3.80	1,555	4.90	2,985	6.00	4,690
2.80	685	3.90	1,665	5.00	3,140	6.20	5,010
2.90	755	4.00	1,780	5.10	3,295	6.40	5,350
3.00	830	4.10	1,895	5.20	3,450	6.60	5,710
3.10	905	4.20	2,015	5.30	3,605	6.80	6,080
3.20	985	4.30	2,140	5.40	3,760	7.00	6,460
3.30	1,070	4.40	2,270	5.50	3,915	7.20	6,840
3.40	1,160	4.50	2,405	5.60	4,070	7.40	7,220
3.50	1,255	4.60	2,545	5.70	4,225	7.60	7,600
3.60	1,350	4.70	2,690	5.80	4,380	7.80	7,980

NOTE.—The above table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1905 and 1906. It is well defined between gage heights 3.3 feet and 6 feet.

Monthly discharge of Des Moines River at Fort Dodge, Iowa, for 1906.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
March (26–31)	[a] 12,000	4,380	7,220
April	5,350	2,080	3,880
May	4,850	1,120	2,220
June	1,780	905	1,390
July (1–19)	1,260	550	828

[a] Discharge estimated.

NOTE.—Values are rated as follows: March to June, excellent; July, good.

DES MOINES RIVER AT DES MOINES, IOWA.

This station was established May 24, 1905, and was discontinued July 20, 1906. It was located at the Interurban Bridge at Des Moines, Iowa, near the suburb of Highland Park. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 92, where are given also references to publications that contain data for previous years.

Discharge measurements of Des Moines River at Des Moines, Iowa, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 10	A. H. Horton	284	1,910	7.50	3,420
April 4	M. S. Brennan	289	2,440	8.90	5,650
May 22	do	278	1,680	6.96	2,500

Daily gage height, in feet, of Des Moines River at Des Moines, Iowa, for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Day.	Mar.	Apr.	May.	June.	July.
1	8.6	10.2	7.8	6.6	6.2	17	8.0	11.7	8.2	6.1	5.7
2	8.4	9.1	8.5	6.6	6.1	18	7.9	11.5	8.0	6.1	5.8
3	8.3	8.8	9.3	6.6	6.1	19	8.0	10.4	7.8	6.9	5.8
4	8.3	8.75	9.6	6.5	6.1	20	8.0	9.3	7.7	6.6	5.8
5	7.9	9.0	9.4	6.5	6.05	21	7.6	9.35	7.5	6.4	.....
6	7.6	8.8	9.0	6.4	6.0	22	7.4	9.0	7.4	6.3	.....
7	7.6	8.75	8.4	6.4	6.0	23	7.4	8.6	7.3	6.3	.....
8	7.4	8.8	8.1	6.3	5.9	24	7.6	8.3	7.1	6.4	.....
9	7.3	8.9	7.7	6.3	5.9	25	7.7	7.6	7.1	6.3	.....
10	6.7	9.5	7.4	6.4	5.9	26	8.8	7.3	7.0	6.3	.....
11	6.9	9.7	7.2	6.4	5.7	27	9.6	7.5	6.9	6.2	.....
12	7.3	9.7	7.1	6.3	5.75	28	11.5	7.3	6.8	6.2	.....
13	8.0	10.3	7.0	6.2	5.8	29	12.5	7.3	6.7	6.1	.....
14	8.2	10.6	6.8	6.2	5.7	30	12.9	7.4	6.7	6.1	.....
15	8.1	11.1	6.8	6.2	5.8	31	11.8	.....	6.6	.....	.....
16	8.0	11.4	6.9	6.1	5.7						

NOTE.—River open March 1 to 12, but frozen March 13 to 25.

Rating table for Des Moines River at Des Moines, Iowa, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.20	790	6.60	2,130	8.00	4,100	9.80	7,320
5.30	860	6.70	2,250	8.10	4,260	10.00	7,700
5.40	940	6.80	2,370	8.20	4,430	10.20	8,100
5.50	1,020	6.90	2,490	8.30	4,600	10.40	8,500
5.60	1,100	7.00	2,620	8.40	4,770	10.60	8,900
5.70	1,190	7.10	2,760	8.50	4,940	10.80	9,300
5.80	1,280	7.20	2,900	8.60	5,110	11.00	9,700
5.90	1,370	7.30	3,040	8.70	5,290	11.20	10,100
6.00	1,470	7.40	3,190	8.80	5,470	11.40	10,520
6.10	1,570	7.50	3,340	8.90	5,650	11.60	10,940
6.20	1,680	7.60	3,490	9.00	5,830	11.80	11,360
6.30	1,790	7.70	3,640	9.20	6,200	12.00	11,780
6.40	1,900	7.80	3,790	9.40	6,570	13.00	13,940
6.50	2,010	7.90	3,940	9.60	6,940		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 5 discharge measurements made during 1905–6. It is well defined between gage heights 5.5 feet and 9 feet.

Monthly discharge of Des Moines River at Des Moines, Iowa, for 1906.

[Drainage area, 6,460 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
March	13,700	2,250	5,000	0.774	0.89
April	11,200	3,040	6,310	.977	1.09
May	6,940	2,130	3,580	.554	.64
June	2,490	1,570	1,840	.285	.32
July (1–20)	6,800	1,190	1,620	.251	.19

NOTE.—Values are rated as follows: March, good; April to July, excellent. Flow during March was probably not greatly affected by ice conditions.

DES MOINES RIVER AT KEOSAUQUA, IOWA.

This station was established May 30, 1903, and discontinued July 21, 1906. It is located on the county bridge, one-fourth mile above the old dam site and Government locks. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 94, where are given also references to publications that contain data for previous years. The data collected at this point are valuable for water-power purposes.

Discharge measurements of Des Moines River at Keosauqua, Iowa, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec. ft.*
January 13	M. S. Brennan	565	1,980	2.45	[a] 2,260
March 12	A. H. Horton	587	2,870	3.64	7,860
April 5	M. S. Brennan	588	4,290	5.93	14,600
May 21	do	584	2,710	3.34	6,960

[a] River frozen entirely across; gage height to bottom of ice is 2.10 feet; ice 0.3 to 1.0 foot thick. The discharge was about 50 per cent of the open-channel rating for gage height 2.45 feet.

Daily gage height, in feet, of Des Moines River at Keosauqua, Iowa, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	1.52	3.15	6.50	9.40	3.58	2.20	2.62
2	1.50	3.18	6.60	9.08	3.50	2.15	2.10
3	1.80	3.20	5.90	7.65	3.32	2.10	2.18
4	3.00	2.95	5.35	6.42	3.32	2.05	2.68
5	3.35	2.55	4.98	5.95	3.95	2.00	2.95
6	3.60	2.45	4.58	5.85	4.60	2.00	2.02
7	.....	2.20	4.12	5.62	4.70	2.42	1.70
8	.....	2.02	3.92	5.50	4.62	2.70	1.52
9	.....	1.85	4.40	5.75	4.42	2.60	1.42
10	.....	1.80	4.40	5.85	4.10	2.05	1.30
11	.....	3.15	4.00	6.52	3.75	1.88	1.28
12	.....	4.55	3.60	6.55	3.50	1.72	1.20
13	2.55	2.00	3.20	6.05	3.12	1.68	1.20
14	.....	3.45	3.05	6.22	2.95	1.60	1.25
15	.....	2.95	2.32	7.10	2.78	1.55	1.20
16	.....	3.40	2.02	7.82	2.68	1.48	1.10
17	.....	5.30	2.02	7.18	2.52	1.42	1.15
18	.....	5.60	2.08	7.75	2.80	1.40	1.18
19	.....	1.75	2.05	6.62	3.42	1.40	1.15
20	6.15	2.48	1.98	6.35	3.50	2.65	1.15
21	7.90	6.00	1.98	5.80	3.35	2.10	1.12
22	5.90	5.62	2.00	5.22	3.02	2.18	.....
23	3.95	7.30	2.20	4.88	2.75	2.00	.....
24	3.20	8.75	2.48	4.48	2.60	2.02	.....
25	3.10	10.65	2.55	4.22	2.45	1.92	.....
26	2.90	7.75	5.55	3.95	2.32	1.90	.....
27	2.48	6.02	8.70	3.68	2.25	1.88	.....
28	2.18	6.28	9.28	3.52	2.28	1.82	.....
29	2.08	.....	9.40	3.55	2.30	1.72	.....
30	2.30	.....	9.88	3.52	2.30	2.18	.....
31	2.72	.....	9.80	.....	2.25		.....

NOTE.—Ice conditions January 4 to 20, February 11 to 18. Ice gorged February 15 to 18.

Rating table for Des Moines River at Keosauqua, Iowa, for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	1,350	2.40	4,285	3.70	7,740	6.00	14,550
1.20	1,550	2.50	4,540	3.80	8,010	6.20	15,210
1.30	1,755	2.60	4,795	3.90	8,280	6.40	15,870
1.40	1,965	2.70	5,055	4.00	8,550	6.60	16,530
1.50	2,180	2.80	5,320	4.20	9,090	6.80	17,210
1.60	2,395	2.90	5,585	4.40	9,650	7.00	17,890
1.70	2,615	3.00	5,850	4.60	10,220	8.00	21,290
1.80	2,840	3.10	6,120	4.80	10,800	9.00	24,790
1.90	3,070	3.20	6,390	5.00	11,400	10.00	28,390
2.00	3,305	3.30	6,660	5.20	12,000	11.00	32,090
2.10	3,545	3.40	6,930	5.40	12,620		
2.20	3,790	3.50	7,200	5.60	13,250		
2.30	4,035	3.60	7,470	5.80	13,890		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1906. It is fairly well defined between gage heights 1.1 feet and 6.4 feet. The table has been extended beyond these limits, being based on one measurement at 15.7 feet.

Monthly discharge of Des Moines River at Keosauqua, Iowa, for 1906.

[Drainage area, 14,300 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	21,000	2,180	[a] 4,160	0.291	0.34
February	30,800	2,700	[b] 8,130	.569	.59
March	28,000	3,260	10,700	.748	.86
April	26,200	7,250	14,600	1.02	1.14
May	10,500	3,910	6,400	.448	.52
June	5,060	1,960	3,260	.228	.25
July (1–21)	5,720	1,350	2,480	.173	.14

[a] Discharge estimated January 4 to 20. [b] Discharge estimated February 11 to 18.

NOTE.—Values are rated as follows: January and February, fair; March to May, excellent; June and July, good.

ILLINOIS RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Illinois River, the most extensive of all the tributaries of the upper Mississippi, enters the main stream from the east about 24 miles above the mouth of the Missouri. Its drainage area of 29,000 square miles is distributed among three States—Illinois, Wisconsin, and Indiana; 24,700 square miles are in Illinois, extending in a broad band 250 miles long and averaging 100 miles in width directly across the center of the State in a northeast-southwest direction; 1,080 square miles are in Wisconsin, extending north from the Illinois area; and 3,210 square miles are in Indiana, projecting east from the same area.

The eastern projection is the basin of Kankakee River, while the northern one consists of the basins of Fox and Des Plaines rivers. The union of the drainages of these projections may be considered the origin of the Illinois. The name Illinois is applied to the river from the junction of the Kankakee and Des Plaines.

The region drained by the Illinois is level and undulating and includes some of the finest land in the United States. Many large and pros-

perous cities are situated within it, and it is covered with a network of railroads.

The drainage into the Illinois is quite evenly distributed along its course. The more important tributaries are Fox and Spoon rivers from the west, and the Kankakee, Vermilion, and Sangamon from the east.

ILLINOIS RIVER NEAR PEORIA, ILL.

This station was established March 10, 1903, and was discontinued July 21, 1906. It is located on the Peoria and Pekin Union Railroad bridge over the Illinois River, 1½ miles southwest of Peoria. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 97, where are given also references to publications that contain data for previous years. The data collected at this station are valuable for the purpose of studying the effect of the Chicago drainage canal on the river.

Discharge measurements of Illinois River near Peoria, Ill., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 15	M. S. Brennan	910	8,030	9.35	[a] 9,250
March 10	do	953	13,900	15.60	27,100
April 6	do	949	13,300	14.94	24,200
May 22	A. H. Horton	914	8,530	9.85	10,300

[a] No ice conditions.

Daily gage height, in feet, of Illinois River near Peoria, Ill., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	8.75	14.00	15.17	15.33	12.62	9.33	7.83
2	8.75	14.08	15.25	15.33	12.46	9.29	7.75
3	8.75	14.00	15.25	15.29	12.29	9.21	7.75
4	8.83	13.83	15.38	15.17	12.25	8.88	7.67
5	8.96	13.67	15.50	15.08	12.17	8.83	7.54
6	9.12	13.42	15.58	14.96	12.04	8.79	7.38
7	9.42	13.33	15.67	14.75	11.79	8.67	7.25
8	9.33	13.25	15.67	14.75	11.75	8.79	7.33
9	9.38	13.17	15.67	14.79	11.50	8.79	7.12
10	9.50	13.04	15.67	14.83	11.38	8.88	7.00
11	9.50	12.83	15.67	14.96	11.12	8.92	6.96
12	9.50	12.75	15.58	15.08	10.96	8.83	6.92
13	9.50	12.67	15.50	15.08	10.92	8.83	6.92
14	9.50	12.67	15.42	15.17	10.83	8.83	6.83
15	9.58	12.67	15.17	15.25	10.67	8.75	6.83
16	9.79	12.67	14.83	15.29	10.46	8.75	6.83
17	9.83	12.67	14.62	15.12	10.71	8.75	6.75
18	9.83	12.58	14.46	14.96	10.50	8.67	6.67
19	9.75	12.50	14.29	14.83	10.42	8.58	6.67
20	9.67	12.50	14.08	14.75	10.21	8.58	6.67
21	10.04	12.96	13.88	14.58	10.00	8.50	6.75
22	10.42	13.17	13.75	14.46	9.88	8.50	.....
23	10.50	13.50	13.67	14.17	9.75	8.50	.....
24	11.17	13.92	13.54	13.83	9.71	8.50	.....
25	11.79	14.25	13.46	13.67	9.54	8.38	.....
26	12.38	14.71	13.42	13.62	9.58	8.33	.....
27	12.83	15.12	13.79	13.38	9.62	8.21	.....
28	13.21	15.17	14.25	13.17	9.67	7.96	.....
29	13.38	.....	14.71	13.00	9.54	7.83	.....
30	13.62	.....	15.17	12.88	9.38	7.92	.....
31	13.79	.....	15.33	.....	9.29	.....	.....

NOTE.—Running ice during greater portion of January, February, and March.

Rating table for Illinois River near Peoria, Ill., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
6.60	6,100	8.10	7,600	9.60	9,710	12.20	15,210
6.70	6,200	8.20	7,780	9.70	9,870	12.40	15.730
6.80	6,300	8.30	7,900	9.80	10,040	12.60	16,270
6.90	6,400	8.40	8,020	9.90	10,210	12.80	16,820
7.00	6,500	8.50	8,140	10.00	10,390	13.00	17,400
7.10	6,600	8.60	8,260	10.20	10,700	13.20	17,990
7.20	6,700	8.70	8,390	10.40	11,140	13.40	18,590
7.30	6,800	8.80	8,520	10.60	11,540	13.60	19,210
7.40	6,900	8.90	8,650	10.80	11,960	13.80	19,840
7.50	7,000	9.00	8,790	11.00	12,390	14.00	20,480
7.60	7,110	9.10	8,930	11.20	12,830	15.00	24,090
7.70	7,220	9.20	9,080	11.40	13,280	16.00	28,600
7.80	7,330	9.30	9,230	11.60	13,740		
7.90	7,440	9.40	9,390	11.80	14,220		
8.00	7,550	9.50	9,550	12.00	14,700		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1906. It is well defined between gage heights 8.3 feet and 16 feet. Below gage height 8 feet the table is approximate.

Monthly discharge of Illinois River near Peoria, Ill., for 1906.

[Drainage area, 13,200 square miles.]

Month.	Discharge in second-feet.			Run-off.	
	Maximum.	Minimum.	Mean.	Sec.-ft. per sq. mile.	Depth in inches.
January	19,800	8,460	11,500	0.871	1.00
February	24,800	16,000	18,700	1.42	1.48
March	27,000	18,700	23,600	1.79	2.06
April	25,500	17,100	22,700	1.72	1.92
May	16,300	9,220	12,000	.909	1.05
June	9,280	7,360	8,350	.633	.71
July (1–21)	7,360	6,170	6,620	.502	.39

NOTE.—Values for 1906 are excellent, except those for July, which are good. Discharge during January to March probably only slightly reduced by floating ice.

DESPLAINES RIVER NEAR CHANNAHON, ILL.

This station was established October 23, 1902, and discontinued July 24, 1906. It is located just above the mouth of Jackson Creek, 2½ miles southwest and 2 miles east of Channahon, Ill. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 100, where are given also references to publications that contain data for previous years. The data collected at this station are valuable for the purpose of studying the effect of the Chicago drainage canal on the river.

Daily gage height, in feet, of Desplaines River near Channahon, Ill., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	83.42	82.18	81.95	.....	83.15	83.25	84.20
2	83.40	82.65	81.95	.....	82.95	83.22	84.25
3	83.42	82.58	81.28	82.90	82.90	83.15	84.18
4	83.30	82.68	81.44	82.90	82.82	83.16	84.22
5	83.50	82.44	81.36	82.90	82.90	83.15	84.12
6	83.30	82.52	81.75	82.92	82.95	83.15	84.18
7	83.05	82.55	82.05	82.95	82.98	83.12	84.28
8	83.00	82.61	82.25	82.60	82.00	83.22	84.08
9	83.18	82.68	82.32	82.22	83.15	83.26	84.10
10	82.82	82.82	82.42	81.82	83.16	83.28	84.05
11	82.80	83.00	82.45	81.84	83.08	83.25	83.95
12	82.78	82.82	82.50	81.90	83.24	83.20	83.92
13	82.68	82.86	82.75	82.15	83.25	83.26	83.82
14	82.88	82.45	83.00	82.25	83.10	83.24	84.02
15	82.95	83.02	82.50	82.36	83.15	83.22	83.82
16	83.05	82.59	83.00	82.42	82.90	83.28	83.88
17	82.85	82.56	82.98	82.58	83.05	83.28	84.00
18	82.85	82.68	82.98	82.52	83.12	83.24	83.92
19	82.72	82.74	82.88	82.62	83.18	83.21	83.90
20	82.70	82.78	83.40	82.78	83.15	83.18	83.85
21	82.36	80.98	83.35	82.80	83.11	83.25	83.65
22	80.60	81.70	83.50	82.93	83.18	83.30	83.20
23	80.98	81.45	82.90	83.00	83.24	83.22	83.42
24	81.72	80.25	83.20	83.08	82.98	83.22	83.85
25	81.92	79.82	83.05	83.05	83.10	83.66	.....
26	81.84	80.48	82.80	83.00	83.15	84.20	.....
27	81.98	81.20	81.90	82.98	.....	84.25	.....
28	82.00	81.60	81.90	83.09	83.10	84.25	.....
29	82.00	.....	81.80	83.10	83.30	.....	.....
30	81.82	.....	81.85	83.16	83.22	84.20	.....
31	81.21	.....	82.30	.....	83.15	.....	.....

NOTE.—No estimates have been published for 1905 or 1906, as no discharge measurements were made. So far as known, the 1904 rating table is applicable for these two years, but as the information is very meager, there is a large element of uncertainty.

KANKAKEE RIVER AT DAVIS, IND.

This station was established July 13, 1905, and was discontinued July 21, 1906. It is located at the railroad bridge at Davis, 8 miles west of Hamlet, Ind. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 101. The data collected are valuable in connection with the drainage of Kankakee Swamp.

Discharge measurements of Kankakee River at Davis, Ind., in 1905 and 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
1905.					
August 22	M. S. Brennan	72	241	4.55	213
October 3	do	74	238	4.70	317
1906.					
April 28	E. F. Kriegsman	75	354	5.55	463
June 12	do	69	257	5.07	294
June 30	do	64	214	4.60	272

Daily gage height, in feet, of Kankakee River at Davis, Ind., for 1906.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1	.....	5.4	4.9	4.8	17	.....	5.1	4.9	4.6
2	.....	5.5	4.8	4.6	18	.....	5.0	4.8	4.5
3	.....	5.5	4.8	4.5	19	.....	5.0	4.7	4.4
4	.....	5.5	4.8	4.6	20	.....	4.9	4.9	4.2
5	.....	5.4	4.8	4.6	21	.....	4.9	5.0	4.1
6	.....	5.3	4.8	4.5	22	.....	4.8	4.9	.....
7	.....	5.4	4.8	4.4	23	.....	4.8	4.8	.....
8	.....	5.4	5.0	4.4	24	.....	4.8	4.8	.....
9	.....	5.5	5.8	4.4	25	.....	4.8	4.7	.....
10	.....	5.4	5.8	4.4	26	.....	4.8	4.7	.....
11	.....	5.3	5.6	4.3	27	.....	5.1	4.7	.....
12	.....	5.2	5.5	4.2	28	5.5	5.2	4.7	.....
13	.....	5.4	5.4	4.2	29	5.5	5.1	4.6	.....
14	.....	5.5	5.3	4.3	30	5.5	5.0	4.6	.....
15	.....	5.4	5.1	4.3	31	.....	5.0	.....	.....
16	.....	5.3	5.0	4.4					

Daily discharge, in second-feet, of Kankakee River at Davis, Ind.

JULY TO DECEMBER, 1905.[a]

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	280	260	295	340	595	17	725	240	520	295	385	.....
2	.....	280	690	295	360	570	18	500	225	520	340	385	.....
3	.....	280	960	295	360	515	19	395	225	470	360	385	.....
4	.....	260	1,110	295	340	.....	20	350	260	440	385	385	.....
5	.....	225	1,140	295	360	.....	21	305	240	415	385	385	.....
6	.....	420	1,110	295	360	.....	22	280	280	390	385	385	.....
7	.....	350	960	295	510	.....	23	260	225	365	385	360	.....
8	.....	280	750	295	510	.....	24	240	225	340	360	360	.....
9	.....	225	605	295	485	.....	25	240	280	340	360	385	.....
10	.....	225	575	315	460	.....	26	240	305	320	340	385	.....
11	.....	225	520	315	435	.....	27	240	305	300	340	385	.....
12	.....	225	495	315	410	.....	28	260	280	315	340	410	.....
13	.....	260	470	295	410	.....	29	470	280	315	340	435	.....
14	1,000	225	445	275	385	.....	30	420	260	295	315	625	.....
15	1,030	225	395	275	385	.....	31	350	240	.....	295	.....	.....
16	940	260	420	275	385	.....							

APRIL TO JULY, 1906.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1	.....	425	270	315	17	.....	330	280	270
2	.....	450	250	270	18	.....	305	260	250
3	.....	450	.....	250	19	.....	305	240	235
4	.....	450	.....	270	20	.....	285	295	200
5	.....	425	.....	270	21	.....	285	315	180
6	.....	385	.....	250	22	.....	260	295	.....
7	.....	410	250	235	23	.....	.....	275	.....
8	.....	410	280	235	24	.....	.....	295	.....
9	.....	435	470	235	25	.....	.....	275	.....
10	.....	410	470	235	26	.....	260	275	.....
11	.....	385	420	215	27	.....	330	275	.....
12	.....	360	390	200	28	450	335	290	.....
13	.....	410	370	200	29	450	315	270	.....
14	.....	435	345	215	30	450	295	270	.....
15	.....	410	300	215	31	.....	295	.....	.....
16	.....	385	300	235					

[a] Gage heights for 1905 were published in Water-Supply Paper No. 171.

NOTE.—On account of the shifting character of the river the discharge has been obtained indirectly from the discharge measurements. (See introduction to Water-Supply Paper No. 211.)

Monthly discharge of Kankakee River at Davis, Ind., for 1905–6.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1905.			
July (14–31)	1,030	240	458
August	420	225	262
September	1,140	260	542
October	385	275	321
November	625	340	405
1906.			
May	450	260	355
June	470	240	301
July (1–21)	315	180	237

NOTE.—Values for 1905 and 1906 are approximate, owing to changing conditions of flow at the gaging section.

KANKAKEE RIVER AT MOMENCE, ILL.

This station was established February 22, 1905, and was discontinued July 20, 1906. It is located on the highway bridge in Momence, Ill., about one-half mile below the Chicago and Eastern Illinois Railway bridge. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 102. The data collected at this station are valuable in connection with the drainage of Kankakee Swamp.

Discharge measurements of Kankakee River at Momence, Ill., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 9	M. S. Brennan	501	1,190	3.27	3,920
April 24	E. F. Kriegsman	473	851	2.75	2,350
April 27	do	466	822	2.68	2,230
June 13	do	440	592	2.12	1,200

Daily gage height, in feet, of Kankakee River at Momence, Ill., for 1906.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Day.	Feb.	Mar.	Apr.	May.	June.	July.
1		2.70	2.95	2.52	2.00	1.80	17		3.05	2.95	2.10	2.00	1.65
2		2.70	2.90	2.50	2.00	1.80	18		3.02	2.90	2.10	2.00	1.65
3		3.30	2.90	2.45	2.00	1.80	19		2.95	2.90	2.10	2.05	1.65
4		3.42	2.90	2.42	2.00	1.80	20		2.92	2.82	2.05	2.10	1.65
5		3.35	2.90	2.38	2.00	1.80	21	2.68	2.85	2.80	2.02	2.08	
6		3.25	3.00	2.35	1.95	1.78	22	2.70	2.82	2.80	2.00	2.08	
7		3.20	3.02	2.30	1.98	1.73	23	2.75	2.78	2.75	2.00	2.05	
8		3.35	3.05	2.25	2.08	1.70	24	2.85	2.75	2.75	1.98	2.00	
9		3.30	3.42	2.25	2.20	1.70	25	3.10	2.78	2.70	1.95	1.95	
10		3.30	3.50	2.20	2.20	1.70	26	3.02	2.92	2.70	1.95	1.90	
11		3.20	3.38	2.20	2.20	1.70	27	2.88	3.20	2.65	1.95	1.90	
12		3.12	3.22	2.20	2.18	1.70	28	2.78	3.25	2.65	2.00	1.90	
13		3.05	3.10	2.20	2.10	1.65	29		3.12	2.60	2.00	1.88	
14		3.02	3.08	2.18	2.08	1.65	30		3.00	2.58	2.00	1.85	
15		3.02	3.02	2.12	2.05	1.65	31		3.00		2.00		
16		3.02	3.00	2.10	2.05	1.68							

Rating table for Kankakee River at Momence, Ill., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.60	310	2.10	980	2.60	2,030	3.10	3,210
1.70	410	2.20	1,170	2.70	2,260	3.20	3,460
1.80	520	2.30	1,380	2.80	2,490	3.30	3,710
1.90	650	2.40	1,590	2.90	2,730	3.40	3,970
2.00	810	2.50	1,810	3.00	2,970	3.50	4,230

NOTE.—The above table is applicable only for open-channel conditions. It is based on 9 discharge measurements made during 1905 and 1906. It is well defined between gage heights 2.1 feet and 4 feet. Below gage height 2.1 feet the table is uncertain, as the two lowest measurements are inconsistent.

Monthly discharge of Kankakee River at Momence, Ill., for 1906.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
February (21–28)	3,020	2,210	2,600
March	4,020	2,260	3,110
April	4,230	1,990	2,810
May	1,850	730	1,110
June	1,170	585	861
July (1–20)	520	360	425

NOTE.—Values for 1906 are excellent, except those for July, which are good.

YELLOW RIVER AT KNOX, IND.

This station was established August 21, 1905, and discontinued July 23, 1906. It is located on the North Heaton Street Highway Bridge, 100 rods north of the New York, Chicago, and St. Louis Railroad. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 104. The data are valuable in connection with the drainage of Kankakee Swamp.

Discharge measurements of Yellow River at Knox, Ind., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 21	M. S. Brennan	91	98	2.02	142
October 3	do	94	96	2.03	151
1906.					
March 11	E. F. Kriegsman	120	294	4.65	664
April 28	do	84	158	3.06	294
June 11	do	117	269	4.07	491
June 12	do	117	241	3.68	438
June 12	do	116	198	3.46	381
June 28	do	92	120	2.59	249

Daily gage height, in feet, of Yellow River at Knox, Ind., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Day.	Mar.	Apr.	May.	June.	July.
1	3.4	5.1	2.7	2.6	2.5	17	3.3	5.7	2.4	2.6	2.0
2	3.7	5.0	2.8	2.6	2.4	18	3.2	5.0	2.35	2.5	2.0
3	4.0	4.0	2.85	2.5	2.35	19	3.2	4.7	2.3	2.35	2.1
4	5.9	3.8	2.9	2.4	2.35	20	3.15	3.9	2.3	2.4	2.0
5	6.4	3.5	2.8	2.2	2.2	21	3.1	3.7	2.3	2.5	1.9
6	6.95	3.8	2.85	2.3	2.1	22	3.0	3.5	2.25	2.5	2.0
7	6.65	4.1	2.7	2.5	2.0	23	3.0	3.3	2.2	2.5	2.0
8	5.7	4.2	2.6	2.6	1.9	24	2.9	3.15	2.2	2.4	.....
9	5.2	4.3	2.55	3.5	1.9	25	3.0	3.0	2.2	2.3	.....
10	5.15	4.5	2.5	4.3	2.0	26	3.3	3.0	2.4	2.25	.....
11	4.65	4.9	2.5	4.5	2.1	27	4.3	3.1	2.5	2.2	.....
12	4.4	4.7	2.45	3.7	2.15	28	6.4	3.05	2.6	2.7	.....
13	4.0	4.5	2.45	3.1	2.1	29	6.1	2.9	2.7	2.6	.....
14	3.8	4.7	2.4	2.8	2.0	30	6.0	2.8	2.75	2.5	.....
15	3.5	4.8	2.4	2.7	2.0	31	5.4	.....	2.7	.....	.....
16	3.4	5.4	2.4	2.7	2.0						

Rating table for Yellow River at Knox, Ind., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	56	2.20	171	3.40	368	5.20	792
1.10	63	2.30	185	3.50	387	5.40	848
1.20	70	2.40	199	3.60	407	5.60	906
1.30	78	2.50	214	3.70	428	5.80	966
1.40	86	2.60	230	3.80	449	6.00	1,028
1.50	94	2.70	246	3.90	471	6.20	1,094
1.60	103	2.80	262	4.00	493	6.40	1,155
1.70	113	2.90	278	4.20	539	6.50	1,187
1.80	123	3.00	294	4.40	586	6.60	1,219
1.90	133	3.10	312	4.60	634	6.80	1,284
2.00	145	3.20	330	4.80	685	7.00	1,350
2.10	158	3.30	349	5.00	738		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1905–6. It is well defined between gage heights 2 feet and 5 feet. Beyond these limits the table is approximate.

Monthly discharge of Yellow River at Knox, Ind., for 1905–6.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1905.[a]			
August (21–31)	133	56	77.7
September	294	133	215
October	230	86	144
November	294	145	199
December (1–16)	387	214	320
1906.			
March	1,330	278	628
April	936	262	524
May	278	171	218
June	610	171	254
July (1–23)	214	133	157

[a] For 1905 gage heights see Water-Supply Paper No. 171.

NOTE.—Values are rated as follows: August, 1905, fair; October, 1905, good; remainder of the above period, excellent.

FOX RIVER AT SHERIDAN, ILL.

This station was established in September, 1905, and was discontinued July 20, 1906. It is located at the Glen Park highway bridge at Sheridan, Ill. The conditions at this station and the bench marks are described in Water-Supply Paper No. 171, page 105. The data collected are valuable for water-power purposes.

Discharge measurements of Fox River at Sheridan, Ill., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
September 19	Hanna and Brennan	199	1,020	4.05	1,100
October 31	M. S. Brennan	199	1,000	4.12	1,080
1906.					
March 11	M. S. Brennan	196	1,340	5.70	3,330
March 29	A. H. Horton	204	1,340	5.70	3,320
March 30	do	204	1,320	5.60	3,180
May 21	do	199	916	3.58	596
May 21	do	199	916	3.58	595
June 20	M. S. Brennan	198	814	3.20	387

Daily gage height, in feet, of Fox River at Sheridan, Ill., for 1906.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Day.	Feb.	Mar.	Apr.	May.	June.	July.
1	.....	6.3	5.5	4.25	3.75	3.65	17	.....	5.1	5.35	3.85	3.25	2.95
2	.....	6.65	5.4	4.6	3.6	3.3	18	.....	5.2	5.3	3.85	3.0	3.0
3	.....	8.2	5.3	4.65	3.45	3.4	19	.....	5.1	5.2	3.8	3.2	3.05
4	.....	7.35	5.25	4.35	3.3	3.4	20	.....	4.95	5.1	3.75	3.25	3.05
5	.....	6.7	5.1	4.25	3.5	3.1	21	.....	4.85	5.0	3.65	3.15	.....
6	.....	6.7	5.3	4.15	3.55	3.15	22	6.8	4.5	4.85	3.85	3.05	.....
7	.....	6.5	5.2	4.0	3.45	3.2	23	6.15	4.45	4.75	3.8	3.1	.....
8	.....	6.45	5.15	4.2	3.35	3.05	24	6.7	4.25	4.75	4.0	3.05	.....
9	.....	6.35	5.9	4.15	3.3	3.0	25	9.05	4.70	4.6	4.15	3.0	.....
10	.....	6.25	6.35	4.1	3.4	3.25	26	7.6	4.85	4.55	4.0	3.0	.....
11	.....	6.1	6.0	4.05	3.15	3.05	27	6.5	7.40	4.45	3.9	3.0	.....
12	.....	5.8	5.75	4.0	3.2	3.0	28	6.5	6.9	4.4	3.8	3.25	.....
13	.....	5.35	5.65	3.95	3.35	3.15	29	.....	5.9	4.3	4.0	3.1	.....
14	.....	5.1	5.5	3.75	3.4	3.05	30	.....	5.6	4.2	3.95	3.65	.....
15	.....	5.1	5.5	3.95	3.35	3.0	31	.....	5.65	.....	3.70	.....	.....
16	.....	4.9	5.45	3.85	3.4	2.95							

Rating table for Fox River at Sheridan, Ill., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.90	220	4.10	1,100	5.30	2,710	7.00	5,630
3.00	260	4.20	1,210	5.40	2,860	7.20	6,010
3.10	310	4.30	1,330	5.50	3,020	7.40	6,400
3.20	360	4.40	1,450	5.60	3,180	7.60	6,800
3.30	420	4.50	1,570	5.70	3,340	7.80	7,200
3.40	480	4.60	1,700	5.80	3,500	8.00	7,600
3.50	550	4.70	1,830	5.90	3,660	8.20	8,020
3.60	630	4.80	1,970	6.00	3,830	8.40	8,440
3.70	710	4.90	2,110	6.20	4,170	8.60	8,860
3.80	800	5.00	2,260	6.40	4,520	8.80	9,280
3.90	900	5.10	2,410	6.60	4,880	9.00	9,700
4.00	1,000	5.20	2,560	6.80	5,250		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1905–6. It is well defined between gage heights 3.2 feet and 5.7 feet.

Monthly discharge of Fox River at Sheridan, Ill., for 1905–6.

Month.	Discharge in second-feet.		
	Maximum.	Minimum.	Mean.
1905.[a]			
September (20–30)	1,050	710	831
October	1,510	420	863
November	1,210	515	912
1906.			
February (22–28)	9,780	4,080	5,770
March	8,020	1,270	3,570
April	4,430	1,210	2,540
May	1,760	670	1,020
June	755	260	422
July (1–20)	670	240	336

[a] For 1905 gage heights, see Water-Supply Paper No. 171.

NOTE.—Values are rated as follows: 1905 and March to May, 1906, excellent; February, June, and July, 1906, good.

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1900. Water-Supply Papers Nos. 47, 48, 49, 50, 51, and 52; Twenty-second Annual Report, Part IV.
1901. East of Mississippi River, Water-Supply Papers Nos. 65* and 75*.
West of Mississippi River, Water-Supply Papers Nos. 66 and 75*.

1902. East of Mississippi River, Water-Supply Papers Nos. 82 and 83.
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1903. East of Mississippi River, Water-Supply Papers Nos. 97 and 98.
West of Mississippi River, Water-Supply Papers Nos. 99 and 100.
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1905. East of Mississippi River, Water-Supply Papers Nos. 165*, 166*, 167, 168*, 169, 170, and 171.
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1906. East of Mississippi River, Water-Supply Papers Nos. 201, 202, 203, 204, 205, 206, and 207.
West of Mississippi River, Water-Supply Papers Nos. 207, 208, 209, 210, 211, 212, 213, and 214.

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CHARLES D. WALCOTT, DIRECTOR

SURFACE WATER SUPPLY

OF

MISSOURI RIVER DRAINAGE, 1906

BY

ROBERT FOLLANSBEE, R. I. MEEKER, AND J. E. STEWART
DISTRICT HYDROGRAPHERS

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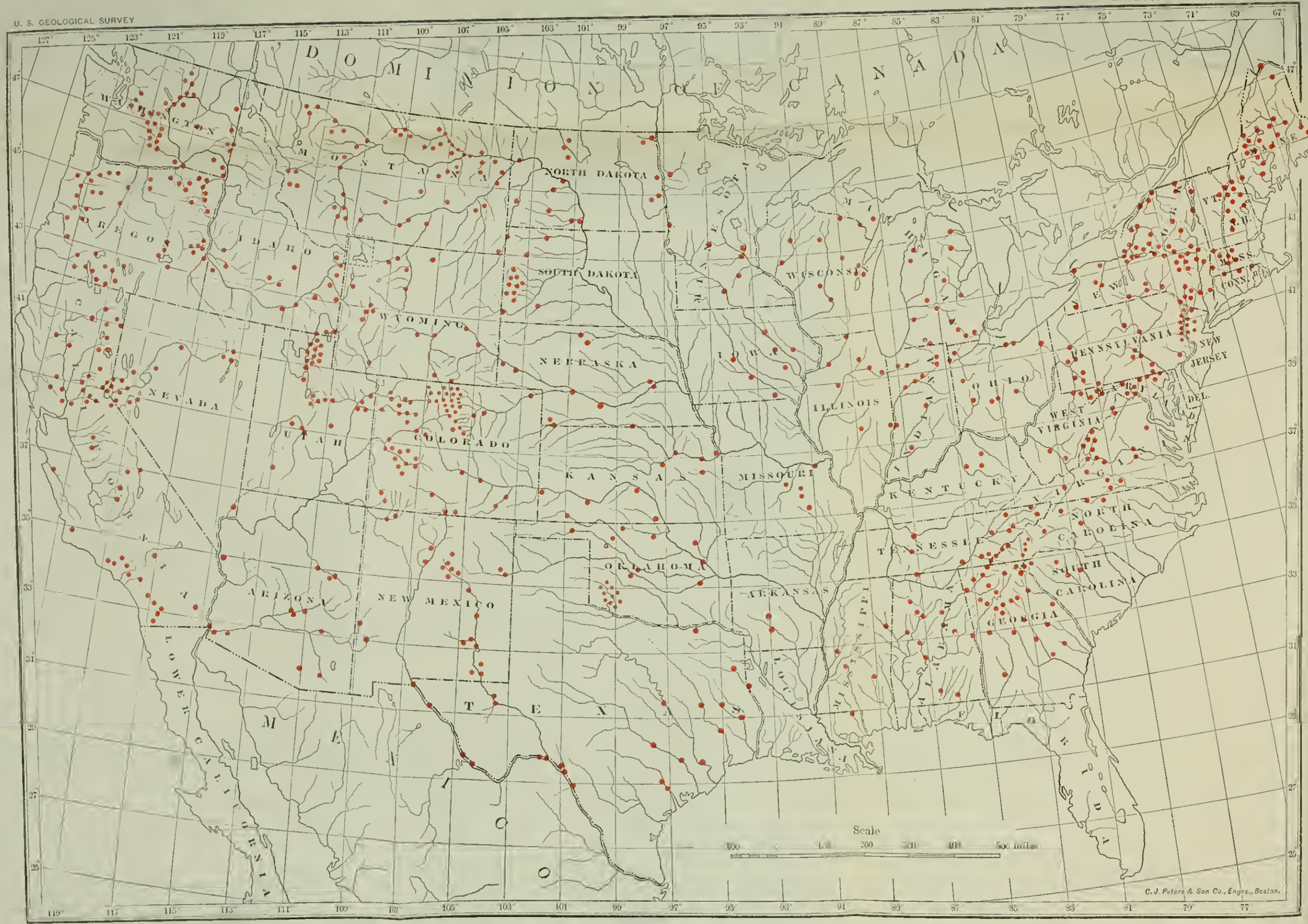


MAP OF UNITED STATES SHOWING LOCATION OF PRINCIPAL RIVER STATIONS MAINTAINED DURING 1906.

SURFACE WATER SUPPLY OF THE MISSOURI RIVER DRAINAGE,[a] 1906.

ROBERT FOLLANSBEE, R. I. MEEKER, and J. E. STEWART,
District Hydrographers.[b]

INTRODUCTION.

SCOPE OF WORK.

The water supply of the United States is of more importance to the life and pursuits of the people than is any other natural resource. In the arid States the limit of agricultural development is determined by the amount of water available for irrigation, while in all parts of the country the increase in the population of cities and towns makes necessary additional water supplies for domestic and industrial uses, in procuring which both the quantity and the quality of the water that may be obtained must be considered. The location of manufacturing plants may depend largely on the water-power facilities and on the character of the water. The notable advances made in the electric transmission of power have led to the utilization of water powers for the operation of manufacturing establishments, railroads, and municipal lighting plants, many of which are at some distance from the places at which the power is developed.

The intelligent establishment and maintenance of enterprises or industries that depend on the use of water demands a thorough knowledge of the flow of the streams and an understanding of the conditions affecting that flow. This knowledge should be based on data showing

[a] This report contains information similar to that published for previous years under the title "Report of Progress of Stream Measurements."

[b] The data presented in this paper, with the following exceptions, have been collected under the direction of Robert Follansbee, district hydrographer, assisted by W. B. Freeman, Gordon Edson, R. H. Whinery, Raymond Richards, and W. S. Hartman;

The data for streams in Nebraska were collected under the direction of Adna Dobson, State engineer, assisted by Arthur Dobson; those for South Dakota, by J. E. Stewart; those for North Dakota, by E. F. Chandler; and those for Colorado and Wyoming, by R. I. Meeker, assisted by A. J. Parshall and T. E. Brick.

All the data have been prepared for publication, under the direction of John C. Hoyt, by R. H. Bolster, F. F. Henshaw, and H. D. Padgett.

both the total flow and the distribution of the flow throughout the year, in order that normal fluctuations may be provided for. As the flow of a stream is variable from year to year estimates of future flow can be made only from a study of observations covering several years. The rapid increase in the development of the water resources of the United States has caused a great demand by engineers for information in regard to the flow of streams, as it is now generally realized that the failure of many large power, irrigation, and other projects has been due to the fact that the plans were made without sufficient trustworthy information in respect to the water supply.

Owing to the broad scope of these hydrographic investigations and the length of time they should cover in order that the records may be of greatest value, it is, in general, impossible for private individuals to collect the necessary data, and as many of the streams traverse more than one State this work does not properly fall within the province of the State authorities. The United States Geological Survey has therefore, by means of specific appropriations by Congress, for several years systematically made records of stream flow, with the view of ultimately determining all the important features governing the flow of the principal streams of the country. In carrying out this plan stations are established on the streams and maintained for a period long enough to show their regimen or general behavior. When a record that is sufficient for this purpose has been obtained for any stream the work on that stream is discontinued. The order in which the streams are measured is determined by the degree of their importance.

During 1906 the regimen of flow was studied at about 700 stations distributed along the various rivers throughout the United States, as shown on Pl. I. In addition to these records data in regard to precipitation, evaporation, water power, and river profiles were obtained in many sections of the country.

These data have been assembled by drainage areas, and are published in a series of fourteen Water-Supply and Irrigation Papers, Nos. 201 to 214, inclusive, each of which pertains to the surface water resources of a group of adjacent areas. In these papers are embodied not only the data collected in the field, but also the results of computations based on these data, and other information that has a direct bearing on the subject, such as descriptions of basins and the streams draining them, utility of the water resources, etc. The list follows:

Water-Supply and Irrigation Papers on surface water supply, 1906.

201. Surface water supply of New England, 1906. (Atlantic coast of New England drainage.)
202. Surface water supply of the Hudson, Passaic, Raritan, and Delaware river drainages, 1906.
203. Surface water supply of the Middle Atlantic States, 1906. (Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages.)

04. Surface water supply of the Southern Atlantic and Eastern Gulf States, 1906. (Santee, Savannah, Ogeechee, and Altamaha rivers, and eastern Gulf of Mexico drainages.)
05. Surface water supply of the Ohio and lower eastern Mississippi river drainages, 1906.
06. Surface water supply of the Great Lakes and St. Lawrence River drainages, 1906.
07. Surface water supply of Hudson Bay and upper Mississippi River drainages, 1906.
08. Surface water supply of the Missouri River drainage, 1906.
09. Surface water supply of the lower western Mississippi River drainage, 1906.
10. Surface water supply of the western Gulf of Mexico and Rio Grande drainages, 1906.
11. Surface water supply of the Colorado River drainage above Yuma, 1906.
12. Surface water supply of the Great Basin drainage, 1906.
13. Surface water supply of California, 1906. (The Great Basin and Pacific Ocean drainage in California, and Colorado River drainage below Yuma.)
14. Surface water supply of the North Pacific Coast drainage, 1906.

The records at most of the stations discussed in these reports extend ver a series of years. An index of the reports containing such ecords up to and including 1903 has been published in Water-upply Paper No. 119. The following table gives, by years and rimary drainage basins, the numbers of the papers on the surface ater supply, published from 1901 to 1906.

Number of Water-Supply Papers containing results of stream measurements, 1901–1906.[a]

	1901.	1902.	1903.	1904.	1905.	1906.
tlantic coast of New England drainage	65 75	82	97	124	165	201
Iudson, Passaic, Raritan, and Delaware river drainages	65 75	82	97	125	166	202
usquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages	65 75	82 83	97 98	126	167	203
antee, Savannah, Ogeechee, and Altamaha rivers, and eastern Gulf of Mexico drainages	65 75	83	98	127	168	204
hio and lower eastern Mississippi river drainages	65 75	83	98	128	169	205
reat Lakes and St. Lawrence River drainages	65	83	97	129	170	206
Iudson Bay and upper eastern and western Mississippi River drainages	65 66 75	83 84 85	98 99 100	128 130	171	207
Iissouri River drainage	66 75	84	99	130 131	172	208
Ieramec, Arkansas, Red, and lower western Mississippi river drainages	66 75	84	99	131	173	209
Vestern Gulf of Mexico and Rio Grande drainages	66 75	84	99	132	174	210
olorado River drainage above Yuma	66 75	85	100	133	175	211
he Great Basin drainage	66 75	85	100	133	176	212
he Great Basin and Pacific Ocean drainages in California, and Colorado River drainage below Yuma	66 75	85	100	134	177	213
orth Pacific Coast drainage	66 75	85	100	135	178	214

[a] Reports containing data for years prior to 1901 are noted in the series list at the end of this paper.

DEFINITIONS.

The volume of water flowing in a stream—the "run-off" or "dis-harge"—is expressed in various terms, each of which has become ssociated with a certain class of work. These terms may be divided

into two groups: (1) Those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet per square mile; and (2) those which represent the actual quantity of water, as run-off in depth in inches and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the quantity of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed.

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the quantity of water that passes through an orifice 1 inch square under a head which varies locally. It has been commonly used by miners and irrigators throughout the West, and is defined by statute in each State in which it is used.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly, both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

"Acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. It is commonly used in connection with storage for irrigation work. There is a convenient relation between the second-foot and the acre-foot: One second-foot flowing for twenty-four hours will deliver 86,400 cubic feet, or approximately 2 acre-feet.

EXPLANATION AND USE OF TABLES.

For each regular gaging station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of monthly and yearly discharges and run-off.
6. Tables showing discharge and horsepower and the number of days during the year when the same are available.

The descriptions of stations give such general information about the locality and equipment as would enable the reader to find and

use the station, and they also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, the name of the hydrographer, the width and area of cross section, the gage height, and the discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage heights taken each day. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. At most stations the gage is read in the morning and in the evening.

The discharge measurements and gage heights are the base data from which the other tables are computed. In cases of extensive development it is expected that engineers will use these original data in making their calculations, as the computations made by the Survey are based on the data available at the time they are made and should be reviewed, and, if necessary, revised when additional data are available.

The rating table gives the discharge in second-feet corresponding to various stages of the river as given by the gage heights. It is published to enable engineers to determine the daily discharge, in case this information is desired.

In the table of monthly discharge, the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise, in the column of "Minimum," the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow for each second during the month. Upon this the computations for the remaining columns, which are defined on page 4, are based.

The values in the table of monthly discharge are intended to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates.

In most work where data in regard to flow are used the regimen of flow is of primary importance. Therefore, for the principal stations, tables have been prepared showing the horsepower that can be developed at various rates of flow, and the length of time that these rates of flow and the corresponding horsepower are available.

These tables have been prepared on a basis of 80 per cent efficiency on the turbines, and the horsepower per foot of fall is given in order that the reader can determine the horsepower for any fall.

In the computations, sufficient significant figures have been used so that the percentage of error in the tables will not in general exceed 1 per cent. Therefore, most of the values in the tables are given to only three significant figures. In making the various computations Thatcher's slide rule, Crelle's tables, and computation machines have been generally used.

In order to give engineers an idea of the relative value of the various data, notes in regard to accuracy are given as far as possible. This accuracy depends on the general local conditions at the gaging stations and the amount of data collected. Every effort possible is made to so locate the stations that the data collected will give a high degree of accuracy. This is not always possible but it is considered better to publish rough values with explanatory notes rather than no data.

In the accuracy notes the following terms have been used indicating the probable accuracy, in per cent, of the mean monthly flow. As these values are mean values, the error in the value for the flow of any individual day may be much larger.

Excellent indicates that the mean monthly flow is probably accurate to within 5 per cent; good, to within 10 per cent; fair, to within 15 per cent; approximate, to within 25 per cent.

CONVENIENT EQUIVALENTS.

Following is a table of convenient equivalents for use in hydraulic computations:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).

1 second-foot equals 38.4 Colorado miner's inches.

1 second-foot equals 40 Arizona miner's inches.

1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.

1 second-foot equals 6.23 British imperial gallons per second.

1 second-foot for one year covers 1 square mile 1.131 feet deep, 13.572 inches deep.

1 second-foot for one year equals 31,536,000 cubic feet.

1 second-foot equals about 1 acre-inch per hour.

1 second-foot for one day covers 1 square mile 0.03719 inch deep.

1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.

1 second-foot for one 29-day month covers 1 square mile 1.079 inches deep.

1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.

1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.

1 second-foot for one day equals 1.983 acre-feet.

1 second-foot for one 28-day month equals 55.54 acre-feet.

1 second-foot for one 29-day month equals 57.52 acre-feet.

1 second-foot for one 30-day month equals 59.50 acre-feet.

1 second-foot for one 31-day month equals 61.49 acre-feet.

100 California miner's inches equal 18.7 United States gallons per second.
100 California miner's inches equal 96.0 Colorado miner's inches.
100 California miner's inches for one day equal 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches equal 104 California miner's inches.
100 Colorado miner's inches for one day equal 5.17 acre-feet.
100 United States gallons per minute equal 0.223 second-foot.
100 United States gallons per minute for one day equal 0.442 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5.280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1⅓ horsepower equal about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel, realizing 80 per cent of theoretical power.

FIELD METHODS OF MEASURING STREAM FLOW.

The methods used in collecting these data and in preparing them for publication are given in detail in Water-Supply Papers No. 94 (Hydrographic Manual, U. S. Geol. Survey) and No. 95 (Accuracy of Stream Measurements). In order that those who use this report may readily become acquainted with the general methods employed, the following brief descriptions are given:

Streams may be divided, with respect to their physical conditions, into three classes—(1) those with permanent beds; (2) those with beds which change only during extreme low or high water; (3) those with constantly shifting beds. In determining the daily flow special methods are necessary for each class. The data on which the determinations are based and the methods of collecting them are, however, in general the same.

There are three distinct methods of determining the flow of open-channel streams—(1) by measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir; (3) by measurements of the velocity of the current and the area of the cross section. The method chosen for any case depends on the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to the coefficients to be used in the Chezy formula, $v = c\sqrt{R\,s}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The results obtained by the slope method are in general only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value for n to be used in Kutter's formula. The most common use of this method is in determining the flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions.

Weir methods.—When funds are available and the conditions are such that sharp-crested weirs can be erected, these offer the best facilities for determining flow. If dams are suitably situated and constructed they may be utilized for obtaining reliable measurements of flow. The conditions necessary to insure good results may be divided into two classes—(1) those relating to the physical characteristics of the dam itself, and (2) those relating to the diversion and use of water around and through the dam.

The physical requirements are as follows: (*a*) Sufficient height of dam, so that backwater will not interfere with free fall over it; (*b*) absence of leaks of appreciable magnitude; (*c*) topography or abutments which confine the flow over the dam at high stages; (*d*) level crests, which are kept free from obstructions caused by floating logs or ice; (*e*) crests of a type for which the coefficients to be used in $Q = c\,b\,h^{\frac{3}{2}}$, or some similar standard weir formula, are known (see Water-Supply Papers Nos. 180 and 200[a]); (*f*) either no flashboards or exceptional care in reducing leakage through them and in recording their condition.

Preferably there should be no diversion of water through or around the dam. Generally, however, the dam is built for purposes of power or navigation, and part or all of the water flowing past it is diverted for such uses. This water is measured and added to that passing over the dam. To insure accuracy in such determinations of flow the amount of water diverted should be reasonably constant. Furthermore, it should be so diverted that it can be measured, either by

[a] Water-Supply Paper No. 200 replaces No. 150, the edition of which has been exhausted.

a weir, a current meter, or a simple system of water wheels which are of standard make, or which have been rated as meters under working conditions and so installed that the gate openings, the heads under which they work, and their angular velocities may be accurately observed.

The combination of physical conditions and uses of water should be such that the determinations of flow will not involve, for a critical stage of considerable duration, the use of a head on a broad-crested dam, of less than 6 inches. Moreover, when all other conditions are good, the cooperation of the owners or operators of the plant is still essential if reliable results are to be obtained.

A gaging station at a weir or dam has the general advantage of continuity of record through the periods of ice and floods, and the disadvantages of uncertainty of coefficient to be used in the weir formula and of complications in the diversion and use of the water.

Velocity method.—The determination of the quantity of water flowing past a certain section of a stream at a given time is termed a discharge measurement. This quantity is the product of two factors—the mean velocity and the area of the cross section. The mean velocity is a function of surface slope, wetted perimeter, roughness of bed, and the channel conditions at, above, and below the gaging section. The area depends on the contour of the bed and the fluctuations of the water surface. The two principal ways of measuring the velocity of a stream are by floats and current meters.

Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements in order that the data may have the required degree of accuracy. Their essential requirements are practically the same whether the velocity is determined by meters or floats. They are located as far as possible where the channel is straight both above and below the gaging section; where there are no cross currents, backwater, or boils; where the bed of the stream is reasonably free from large projections of a permanent character; and where the banks are high and subject to overflow only at flood stages. The station must be so far removed from the effects of tributary streams and of dams or other artificial obstructions that the gage height shall be an index of the discharge.

Certain permanent or semipermanent structures, usually referred to as "equipment," are generally pertinent to a gaging station. These are a gage for determining the fluctuations of the water surface, bench marks to which the datum of the gage is referred, permanent marks on a bridge or a tagged line indicating the points of measurement, and, where the current is swift, some appliance (generally a secondary cable) to hold the meter in position in the water. As a rule, the stations are located at bridges if the channel conditions are satisfactory,

as from them the observations can more readily be made and the cost of the equipment is small.

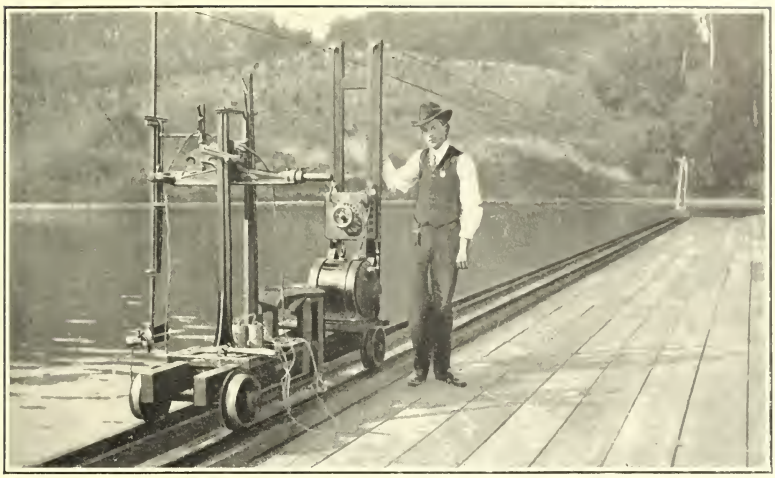
The floats in common use are the surface, subsurface, and tube or rod floats. A corked bottle with a flag in the top and weighted at the bottom makes one of the most satisfactory surface floats, as it is affected but little by wind. In case of flood measurements, good results can be obtained by observing the velocity of floating cakes of ice or débris. In case of all surface-float measurements coefficients must be used to reduce the observed velocity to the mean velocity. The subsurface and tube or rod floats are intended to give directly the mean velocity in the vertical. Tubes give excellent results when the channel conditions are good, as in canals.

In measuring velocity by a float, observation is made of the time taken by the float to pass over the "run," a selected stretch of river from 50 to 200 feet long. In each discharge measurement a large number of velocity determinations are made at different points across the stream, and from these observations the mean velocity for the whole section is determined. This may be done by plotting the mean positions of the floats as indicated by the distances from the bank as ordinates and the corresponding times as abscissas. A curve through these points shows the mean time of run at any point across the stream, and the mean time for the whole stream is obtained by dividing the area bounded by this curve and its axis by the width. The length of the run divided by the mean time gives the mean velocity.

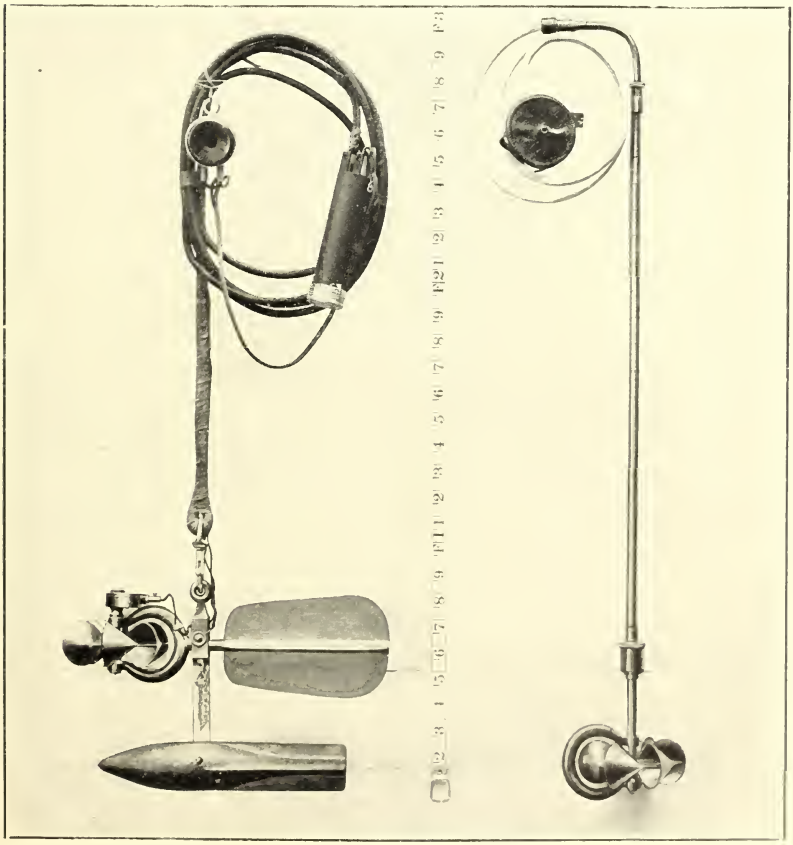
The area used in float measurements is the mean of the areas at the two ends of the run and at several intermediate sections.

The essential parts of the current meters in use are a wheel of some type so constructed that the impact of flowing water causes it to revolve and a device for recording or indicating the number of revolutions. The relation between the velocity of the moving water and the revolutions of the wheel is determined for each meter. This rating is done by drawing the meter through still water for a given distance at different speeds and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity per second for any number of revolutions.

Many kinds of current meters have been constructed. They may, however, be classed in two general types—those in which the wheel is made up of a series of cups, as the Price, and those having a screw-propeller wheel, as the Haskell. Each meter has been developed for use under some special condition. In the case of the small Price meter, shown in Pl. II, *B*, which has been largely developed and extensively used by the United States Geological Survey, an attempt has been made to get an instrument which could be used under practically all conditions.



A. CURRENT-METER RATING STATION AT LOS ANGELES, CAL.



B. PRICE CURRENT METERS.

Current-meter measurements may be made from a bridge, cable, boat, or by wading, and gaging stations may be classified in accordance with such use. Fig. 1 shows a typical cable station.

In making the measurement an arbitrary number of points are laid off on a line perpendicular to the thread of the stream. The points at which the velocity and depth are observed are known as measuring points and are usually fixed at regular intervals, varying from 2 to 20 feet, depending on the size and condition of the stream. Perpendiculars dropped from the measuring points divide the gaging section into strips. For each strip or pair of strips the mean velocity, area, and discharge are determined independently, so that conditions existing in one part of the stream may not be extended to parts where they do not apply.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

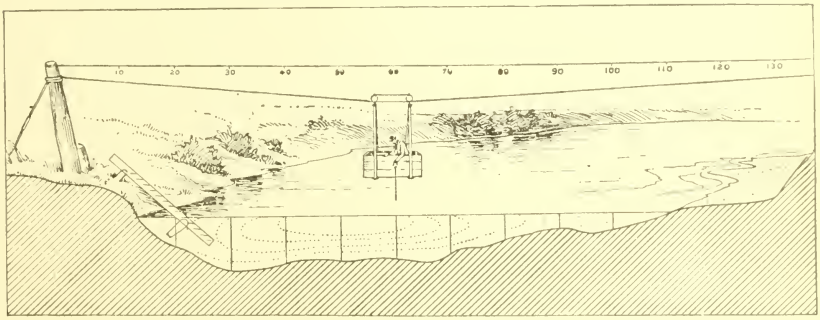


FIG. 1.—Cable station showing section of the river, car, gage, etc.

The three principal multiple-point methods in general use are the vertical velocity-curve; 0.2 and 0.8 depth; and top, bottom, and mid-depth.

In the vertical velocity-curve method a series of velocity determinations are made in each vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates and drawing a smooth curve among the resulting points the vertical velocity-curve is developed. This curve shows, graphically, the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity curve and its axis by the depth. On account of the length of time required to make a complete measurement by this method its use is limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 of the depth, and the mean of the velocities at these two

points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity-curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 of the depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this second multiple-point method gives the mean velocity very closely for open-water conditions, and, moreover, the indications are that it holds nearly as well for ice-covered rivers.

In the third multiple-point method the meter is held at mid-depth, at 0.5 foot below the surface, and at 0.5 foot above the bottom, and the mean velocity is determined by dividing by 6 the sum of the top velocity, four times the mid-depth velocity, and the bottom velocity. The method may be modified by observing at 0.2, 0.6, and 0.8 depth.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined.

Extensive experiments by vertical velocity-curves show that the thread of mean velocity generally occurs at from 0.3 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, at which point the meter is held in a majority of the measurements. A large number of vertical velocity-curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity.

In the other principal single-point method the meter is held near the surface, usually 1 foot below or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be from 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is specially adapted for flood measurements or when the velocity is so great that the meter can not be kept at 0.6 depth.

The vertical-integration method consists in moving the meter at a slow uniform speed from the surface to the bottom and back again to the surface and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods.

The area, which is the other factor in the velocity method of determining the discharge of a stream, depends on the stage of the river, which is observed on the gage, and on the general contour of the bed of the stream, which is determined by soundings. The soundings are usually taken at each measuring point at the time of the discharge

measurement either by using the meter and cable or by a special sounding line or rod. For streams with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also of value in obtaining the area for use in computations of high-water measurements, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at various points of measurement the measuring section is divided into elementary strips, as shown in fig. 1, and the mean velocity, area, and discharge are determined separately for either a single or a double strip. The total discharge and the area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period, and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8, and vertical velocity-curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, the thickness and character of the ice, etc. From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice.

For information in regard to flow under ice cover see Water-Supply Paper No. 187.

OFFICE METHODS OF COMPUTING RUN-OFF.

There are two principal methods of determining run-off, depending upon whether or not the bed of the stream is permanent.

For stations of streams with permanent beds the first step in computing the run-off is the construction of a rating table, which shows the discharge corresponding to any stage of the stream. This rating table is applied to the record of stage to determine the amount of water flowing. The construction of the rating table depends on the method used in measuring flow.

For a station at a weir or dam the basis for the rating table is some standard weir formula. The coefficients to be used in its application depend on the type of dam and other conditions near its crest. After inserting in the weir formula the measured length of crest and the

assumed coefficient, the discharge is computed for various heads and the rating table constructed.

The data necessary for the construction of a rating table for a velocity-area station are the results of the discharge measurements, which include the record of stage of the river at the time of measurement, the area of the cross section, the mean velocity of the current, and the quantity of water flowing. A thorough knowledge of the conditions at and in the vicinity of the station is also necessary.

The construction of the rating table depends on the following laws of flow for open permanent channels: (1) The discharge will remain constant so long as conditions at or near the gaging station remain constant. (2) The discharge will be the same whenever the stream is at a given stage if the change of slope due to the rise and fall of the stream be neglected. (3) The discharge is a function of and increases gradually with the stage.

The plotting of results of the various discharge measurements, using gage heights as ordinates; and discharge, mean velocity, and area as abscissas will define curves which show the discharge, mean velocity, and area corresponding to any gage height. For the development of these curves there should be, therefore, a sufficient number of discharge measurements to cover the range of the stage of the stream. Fig. 2 shows a typical rating curve with its corresponding mean-velocity and area curves.

As the discharge is the product of two factors, the area and the mean velocity, any change in either factor will produce a corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate soundings extending to the limits of high water. It is always concave toward the horizontal axis or on a straight line, unless the banks of the stream are overhanging.

The form of the mean-velocity curve depends chiefly on the surface slope, the roughness of the bed, and the cross section of the stream. Of these, the slope is the principal factor. In accordance with the relative changes of these factors the curve may be either a straight line, convex or concave toward either axis, or a combination of the three. From a careful study of the conditions at any gaging station the form which the vertical velocity-curve will take can be predicted, and it may be extended with reasonable certainty to stages beyond the limits of actual measurements. Its principal use is in connection with the area curve in locating errors in discharge measurements and in constructing the rating table.

The discharge curve is defined primarily by the measurements of discharge, which are studied and weighted in accordance with the local conditions existing at the time of each measurement. The curve may,

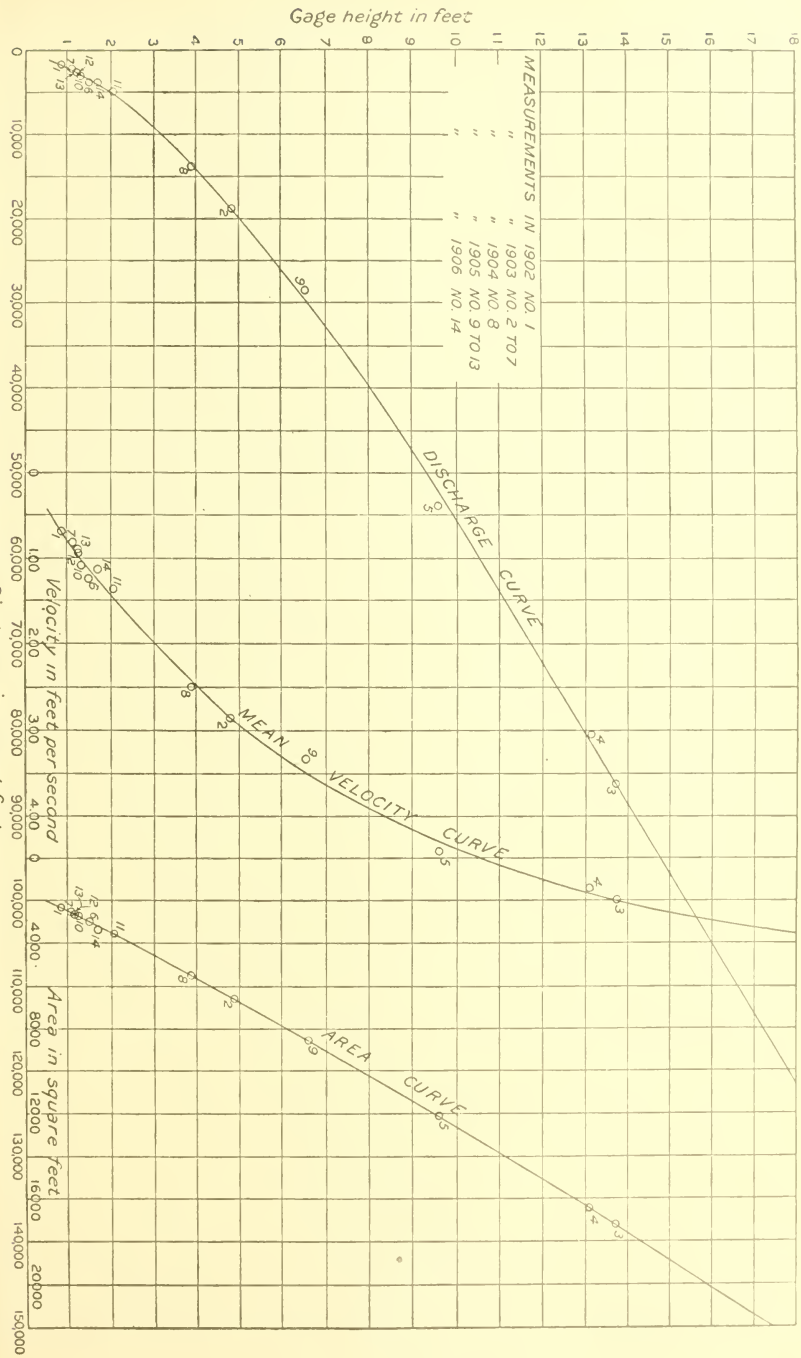


FIG. 2.—Discharge, area, and mean-velocity curves of Potomac River at Point of Rocks, Md.

however, best be located between and beyond the measurements by means of curves of area and mean velocity. The discharge curve under normal conditions is concave toward the horizontal axis and is generally parabolic in form.

In the preparation of the rating table the discharge for each tenth or half tenth on the gage is taken from the curve. The differences between successive discharges are then taken and adjusted according to the law that they shall be either constant or increasing.

The determination of daily discharge of streams with changeable beds is a difficult problem. In case there is a weir or dam available, a condition which seldom exists on streams of this class, the discharge can be determined by its use. In case of velocity-area stations frequent discharge measurements must be made if the determinations of flow are to be other than rough approximations. For stations with beds which shift slowly, or are materially changed only during floods, rating tables can be prepared for periods between such changes and satisfactory results obtained with a limited number of measurements, provided that some of them are taken soon after the change occurs. For streams with continually shifting beds, such as the Colorado and Rio Grande, discharge measurements should be made every two or three days and the discharges for intervening days obtained either by interpolation modified by gage height or by Professor Stout's method, which has been described in full in the Nineteenth Annual Report of the United States Geological Survey, Part IV, page 323, and in the Engineering News of April 21, 1904. This method, or a graphical application of it, is also much used in determining the flow at stations where the bed shifts but slowly.

COOPERATION AND ACKNOWLEDGMENTS.

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The Northern Pacific; Great Northern; Chicago, Burlington and Quincy; Montana, Colorado and Southern; and Union Pacific railroads.

MISSOURI RIVER DRAINAGE.

GENERAL FEATURES.

Missouri River and its innumerable tributaries drain an immense area in the northern and western section of the United States. The northern boundary of this area is approximately the fiftieth parallel, the southern the thirty-ninth; to the west its limit is the Rocky

Mountains, while to the east the divide between it and the upper Mississippi basin crosses eastern North and South Dakota, western Iowa, and northeastern Missouri. Its extent east and west is about 900 miles; north and south it is 600 miles; it comprises a total of 492,000 square miles.

The topography of the basin is of the most varied character, ranging from the mountainous regions of Montana, Wyoming, and Colorado to the rolling prairies of the Dakotas, Nebraska, and Kansas. The upper tributaries drain a forested region, but the main stream flows through a country almost wholly devoid of forests. The precipitation in the mountainous portion of the basin is mainly in the form of heavy snowfall, but a great part of the area lies within the arid and semiarid regions, and it is probable that the average annual precipitation throughout the entire basin is less than 20 inches.

The tributaries are mostly in the upper course of the river and from the western side of the basin. The most important of these tributaries are Musselshell, Marias, Milk, Yellowstone, Cheyenne, Platte, and Kansas rivers.

MISSOURI RIVER BASIN.

DESCRIPTION OF BASIN.

Missouri River proper is formed in southwestern Montana by the union of three streams, which were discovered by Lewis and Clark in 1806 and named by them Jefferson, Madison, and Gallatin rivers. Jefferson and Madison forks come together first, and within 2 miles they are joined by the Gallatin. The head of the Missouri thus formed lies in about latitude 45° 56′ north and longitude 111° 32′ west. Each of the three headwater rivers is about 90 feet wide, flows with great velocity, and discharges large quantities of water. The Gallatin is the most rapid of the three. The beds of all are formed of smooth pebbles and gravel and the waters are perfectly transparent.

From the junction of the three forks the course of the Missouri lies through mountain valleys and deep canyons, from which it finally issues through a gorge in a range of rocks, called by Lewis and Clark the "gates of the Rocky Mountains." Thirty-five miles above Fort Benton the river pours over a series of falls, and from that point onward it is a navigable stream. (See Pls. III and IV.)

From the mouth of the Yellowstone the Missouri follows a winding but on the whole southeasterly course until it is joined by the Kansas; thence it flows more to the east across the State of Missouri, and empties into the Mississippi 16 miles above St. Louis, 189 miles above the

mouth of the Ohio, and 2,824 miles below the junction of its three upper forks.

For the first 350 miles below the union of the three forks the Missouri is a comparatively clear stream, but approximately midway between the forks and the mouth of the Yellowstone its character gradually changes and it becomes turbid. Although a large amount of the sediment carried by the Missouri is undoubtedly brought in by the drainage of its tributaries, the greater part is derived from the caving of its banks.

The volume of the Missouri is subject to great variations, the ordinary high-water discharge at the mouth being about 28 times the low-water discharge. The freshets are caused by melting snow and heavy summer rains. The amount of snow falling on the prairies is usually small, but among the Rocky Mountains the snows begin early, continue late, and accumulate to great depths. The regular floods occur in May and June, the June rise being as a rule higher and lasting longer. Thereafter the river steadily decreases in volume, the minimum being reached during the winter months.

MISSOURI RIVER AT CASCADE, MONT.

This station was established July 20, 1902. It is located at the highway bridge at the east end of the town of Cascade, Mont., about one-fourth mile from the railroad. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 24, where are given also references to publications that contain data for previous years.

Discharge measurements of Missouri River at Cascade, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 24	G. Edson		2,690	5.19	6,190
May 12	do		3,070	5.88	7,880
June 3	do	450	3,800	7.28	14,400
June 25	Edson and Richards	420	3,720	6.42	10,400
August 20	R. Richards	357	2,520	3.55	2,310
September 17	Grover and Follansbee	362	2,620	3.92	2,620
October 31	R. Richards	363	2,770	4.30	3,480

GREAT FALLS OF THE MISSOURI, MONTANA.

Daily gage height, in feet, of Missouri River at Cascade, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.70	4.00	4.30	5.00	5.40	7.40	5.20	3.82	3.68	4.00	4.05	7.40
2	4.70	4.00	4.30	5.00	5.40	7.35	5.20	3.72	3.72	4.00	4.10	7.38
3	4.70	3.90	4.30	5.02	5.42	7.25	5.18	3.70	3.80	4.00	4.12	7.32
4	4.70	3.90	4.30	5.10	5.59	6.95	5.12	3.68	3.88	4.00	4.18	7.28
5	4.70	3.90	4.30	5.12	5.58	6.85	5.25	3.70	3.92	4.00	4.22	7.25
6	4.70	3.90	4.30	5.18	5.65	6.75	5.50	3.82	4.02	4.00	4.28	7.12
7	4.70	3.90	4.30	5.20	5.70	6.98	5.42	3.72	3.98	4.00	4.32	7.00
8	4.70	3.90	4.30	5.18	5.78	7.12	5.30	3.58	4.02	4.00	4.38	6.85
9	4.70	3.90	4.30	5.12	5.88	7.22	5.00	3.48	4.02	4.00	4.42	6.70
10	4.70	3.90	4.30	5.05	5.95	7.25	4.75	3.40	3.98	4.00	4.50	6.58
11	4.80	4.00	4.40	4.95	6.00	7.18	4.70	3.40	3.98	4.00	4.55	6.45
12	4.80	4.10	4.80	4.85	6.08	7.08	4.70	3.40	3.98	4.00	4.62	6.32
13	4.90	4.20	5.15	4.70	6.18	7.15	4.70	3.40	3.98	4.00	4.68	6.22
14	4.70	4.30	5.30	4.60	6.25	7.20	4.75	3.40	3.98	4.00	4.75	6.12
15	4.70	4.45	5.45	4.70	6.30	7.65	4.70	3.40	3.98	4.00	4.82	6.02
16	4.70	4.60	5.60	4.75	5.98	7.75	4.65	3.40	3.98	4.00	4.92	5.92
17	4.70	4.95	5.75	4.80	6.30	7.72	4.60	3.42	3.95	4.00	5.00	5.75
18	4.80	5.20	5.95	4.90	6.30	7.82	4.60	3.45	3.98	4.00	5.05	5.55
19	4.80	5.10	6.10	4.92	6.30	7.95	4.60	3.45	4.02	4.00	5.10	5.50
20	4.60	5.00	6.10	4.98	6.30	7.85	4.60	3.45	4.12	4.00	5.18	5.60
21	4.70	4.90	6.10	5.00	6.22	7.65	4.65	3.45	4.22	4.05	5.22	5.70
22	4.80	4.80	6.10	5.00	6.18	7.45	4.60	3.45	4.32	4.05	5.32	5.80
23	4.90	4.60	6.10	5.00	6.02	6.92	4.55	3.50	4.40	4.05	5.38	5.88
24	4.80	4.45	6.10	5.00	5.95	6.58	4.52	3.55	4.40	4.05	5.45	5.90
25	4.70	4.30	6.10	5.05	6.02	6.40	4.50	3.58	4.40	4.05	7.15	5.88
26	4.50	4.30	5.00	5.05	6.20	6.28	4.45	3.60	4.38	4.05	8.30	5.78
27	4.50	4.30	5.00	5.10	6.50	6.25	4.42	3.60	4.28	4.05	8.30	5.68
28	4.50	4.30	4.60	5.10	6.90	6.16	4.40	3.65	4.18	4.05	8.05	5.58
29	4.50	.....	4.70	5.25	7.25	5.80	4.25	3.65	4.08	4.05	7.85	5.48
30	4.40	.....	4.82	5.45	7.40	5.30	4.05	3.65	4.00	4.05	7.55	5.38
31	4.30	.....	4.92	.....	7.50	.....	3.92	3.70	.....	4.05	.....	5.20

NOTE.—Ice conditions January 19–26 and March 12–25; gage heights are to top of ice. During December the river was frozen, except for an open channel in the center; gage heights are to the water surface.

Rating tables for Missouri River at Cascade, Mont.

JANUARY 1 TO MAY 31, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.00	2,700	4.90	4,900	5.80	7,660	6.70	11,040
4.10	2,900	5.00	5,200	5.90	8,000	6.80	11,480
4.20	3,120	5.10	5,500	6.00	8,340	6.90	11,940
4.30	3,340	5.20	5,800	6.10	8,680	7.00	12,400
4.40	3,560	5.30	6,100	6.20	9,040	7.10	12,880
4.50	3,800	5.40	6,400	6.30	9,400	7.20	13,360
4.60	4,060	5.50	6,700	6.40	9,780	7.30	13,860
4.70	4,320	5.60	7,020	6.50	10,180	7.40	14,380
4.80	4,600	5.70	7,340	6.60	10,600	7.50	14,900

JUNE 1 TO DECEMBER 31, 1906.[b]

3.40	1,950	4.60	4,220	5.80	8,060	7.00	12,740
3.50	2,060	4.70	4,480	5.90	8,420	7.10	13,160
3.60	2,180	4.80	4,760	6.00	8,780	7.20	13,580
3.70	2,320	4.90	5,060	6.10	9,160	7.30	14,020
3.80	2,480	5.00	5,360	6.20	9,540	7.40	14,460
3.90	2,660	5.10	5,680	6.30	9,920	7.50	14,900
4.00	2,840	5.20	6,000	6.40	10,300	7.60	15,340
4.10	3,040	5.30	6,320	6.50	10,700	7.70	15,800
4.20	3,260	5.40	6,660	6.60	11,100	7.80	16,260
4.30	3,480	5.50	7,000	6.70	11,560	7.90	16,720
4.40	3,720	5.60	7,340	6.80	11,900	8.00	17,180
4.50	3,960	5.70	7,700	6.90	12,320		

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905 and 1 measurement in the spring of 1906 and is fairly well defined. Owing to shifting conditions during high water, another rating table is necessary for the remainder of the year.

[b] This table is applicable only for open-channel conditions. It is based upon five discharge measurements made during the latter part of 1906. It is fairly well defined.

Monthly discharge of Missouri River at Cascade, Mont., for 1906.

[Drainage area, 18,300 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	4,900	3,340	4,170	256,000	0.228	0.26
February	5,800	2,500	3,480	193,000	.190	.20
March (17 days)	5,200	3,340	3,840	129,000	.210	.13
April	6,550	4,060	5,220	311,000	.285	.32
May	14,900	6,400	8,990	553,000	.491	.57
June	17,000	6,320	13,000	774,000	.710	.79
July	7,000	2,700	4,660	287,000	.255	.29
August	2,520	1,950	2,140	132,000	.117	.13
September	3,720	2,290	2,970	177,000	.162	.18
October	2,940	2,840	2,880	177,000	.157	.18
November	9,000	2,940	5,260	313,000	.287	.32
December			7,000	[a] 430,000	.382	.44
The period				3,730,000		

[a] Estimated.

NOTE.—Values are rated as follows: January to April, August, September, and November, fair; May to July, good; October and December approximate. Gage readings during the greater part of the year are subject to more or less error.

MISSOURI RIVER NEAR WILLISTON, N. DAK.

This station was established April 24, 1905. It is located at Bakers Ferry, 10 miles down the river from Williston, N. Dak. The conditions at this station and the bench marks are described in Water Supply Paper No. 172, page 28. The data collected at this station are valuable for irrigation purposes.

Daily gage height, in feet, of Missouri River near Williston, N. Dak., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1						12.4	12.7	8.9	8.0	5.7	5.3	
2						12.8	12.2	8.7	7.9	5.65	5.3	
3		4.6	7.8			12.4	11.5	8.5	7.8	5.6	5.3	
4						12.0	11.0	8.3	7.5	5.55	5.25	
5						11.6	11.0	8.5	7.25	5.5	5.2	
6	5.4		8.0			11.5	11.3	8.65	7.05	5.4	5.3	
7			7.8			12.2	11.35	8.8	7.0	5.4	5.3	
8			7.9			15.9	11.2	8.6	6.95	5.3	5.3	
9			7.55			19.0	11.15	8.4	6.8	5.2	5.5	
10		4.7	7.6			20.1	11.15	8.1	6.6	5.2	5.45	
11			7.55			19.8	11.15	8.0	6.5	5.3	5.6	
12			7.6			18.3	11.0	8.2	6.4	5.25	5.6	
13	4.6		7.9			14.8	10.8	7.9	6.3	5.2	5.6	
14			7.85			14.0	10.6	7.5	6.2	5.25	5.6	
15			7.8			15.05	10.6	7.3	6.3	5.25	5.7	
16			7.7			16.0	10.7	7.1	6.7	5.3	5.7	
17		6.2	7.6			16.1	10.6	6.9	6.85	5.25	5.7	
18			7.4			16.1	10.6	6.85	6.6	5.2	7.8	
19			7.3			15.7	10.9	6.85	6.7	5.2	6.0	
20	4.5		6.9			15.1	10.7	6.7	6.8	5.15	5.6	
21			6.6			14.9	10.5	6.6	6.9	5.15	5.65	
22			6.4			14.3	10.5	6.5	7.0	5.2	5.65	
23			6.3			13.8	10.4	6.4	6.8	5.2	5.6	
24		6.8	6.2			13.3	10.2	6.4	6.5	5.2	5.5	
25			6.2			13.2	9.8	6.8	6.3	5.15		
26			6.1		13.7	13.0	9.6	8.9	6.1	5.2		
27	4.5		6.1		13.9	12.7	9.5	9.9	6.0	5.2		
28			6.3		14.2	13.1	9.4	9.3	5.85	5.15		
29			6.5		13.8	13.2	9.3	8.6	5.85	5.1		
30			12.3		12.85	11.9	9.2	8.4	5.8	5.1		
31			15.0		12.6		9.1	8.2		5.1		

NOTE.—Ice conditions January 1 to March 29 and November 25 to December 31. March 20 ice was 2.4 feet thick. The station was temporarily discontinued April 1 to May 25.

BLACK EAGLE FALLS, MISSOURI RIVER, MONTANA.

MISSOURI RIVER AT KANSAS CITY, MO.

This station was established April 13, 1905. It is located at the Hannibal Railway bridge at the foot of Broadway street, Kansas City, Mo. The gage heights are furnished by the United States Weather Bureau. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 32.

The following discharge measurement was made May 28, 1906:

Width, 870 feet; area of section, 14,600 square feet; gage height, 10.3 feet; discharge, 53,600 second-feet.

Daily gage height, in feet, of Missouri River at Kansas City, Mo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.15	7.05	9.8	14.0	10.3	14.8	16.7	11.2	10.1	10.3	9.2	6.9
2	6.2	6.7	9.4	15.0	11.1	14.6	16.3	11.1	10.1	10.3	9.2	6.9
3	6.15	6.45	9.5	14.5	12.5	14.2	16.0	10.9	9.6	9.7	9.2	6.9
4	6.1	6.65	9.8	14.4	14.9	16.2	16.1	11.0	9.1	9.5	9.2	6.9
5	6.0	6.75	9.9	14.6	14.0	16.6	16.0	11.3	8.8	9.3	9.1	6.8
6	5.9	6.4	9.5	14.7	12.9	17.0	15.6	12.4	9.0	8.8	9.1	7.2
7	5.85	6.25	9.3	14.1	12.4	17.3	15.3	12.2	9.1	8.5	9.1	7.2
8	5.7	6.15	8.6	13.4	12.0	17.1	14.9	11.9	8.7	8.5	8.9	7.2
9	5.65	6.1	8.1	13.3	11.8	16.8	14.7	12.5	8.5	8.3	8.9	7.2
10	4.6	5.8	7.7	14.9	11.9	16.6	14.5	12.6	8.3	8.2	9.0	7.15
11	3.85	5.75	7.4	17.0	12.0	15.0	13.9	13.4	8.0	8.0	8.9	7.0
12	3.85	6.3	7.8	16.1	11.2	14.6	13.6	12.6	7.8	8.1	9.0	6.1
13	4.30	6.55	8.3	15.3	10.8	14.1	13.1	12.1	8.1	7.9	9.0	5.55
14	5.25	6.3	9.7	15.1	10.5	14.0	12.8	11.9	9.0	7.6	9.0	5.35
15	5.6	5.6	8.9	15.2	10.3	14.2	12.5	11.7	9.6	7.5	8.7	5.05
16	6.05	5.4	7.6	14.5	10.1	14.2	12.2	12.0	9.2	7.4	8.7	4.95
17	6.4	5.45	6.3	14.4	9.9	16.2	11.7	12.1	9.5	7.2	8.7	4.85
18	6.05	5.45	5.1	14.0	10.0	17.2	11.4	12.2	9.5	7.5	8.4	4.45
19	6.15	5.45	5.6	13.3	9.8	18.5	11.9	12.0	11.1	7.2	8.3	3.7
20	6.15	7.35	5.4	12.8	9.8	19.4	12.2	11.0	12.4	6.9	8.3	2.95
21	6.55	6.6	5.5	12.4	9.7	19.7	12.1	10.7	12.6	7.1	8.2	2.85
22	6.85	9.25	5.8	12.1	9.6	18.7	12.1	10.0	12.6	6.5	8.3	2.95
23	5.35	8.2	6.1	11.7	9.9	16.7	12.2	10.9	12.9	6.8	8.0	2.9
24	5.4	8.7	6.4	11.4	10.0	16.3	12.0	10.6	12.5	7.1	8.0	2.55
25	5.55	10.2	6.9	11.0	9.9	17.0	11.6	10.3	12.2	7.1	8.4	2.35
26	5.45	10.65	7.3	10.7	10.0	17.2	11.4	10.4	11.3	7.7	8.9	2.6
27	5.95	10.55	9.7	10.5	10.1	17.1	11.1	9.8	11.1	9.1	8.5	3.7
28	6.75	10.3	11.0	10.5	10.4	16.9	11.2	9.5	11.1	9.3	7.5	4.45
29	7.15	.....	12.0	11.0	12.3	16.9	11.0	9.2	11.2	9.3	6.7	4.95
30	7.0	.....	12.8	10.5	13.0	16.8	11.5	9.0	11.5	9.8	6.5	5.45
31	7.0	.....	12.2	.....	13.7	.....	11.8	9.9	.....	9.2	.....	5.9

MISCELLANEOUS MEASUREMENTS IN MISSOURI RIVER DRAINAGE BASIN.

The following miscellaneous measurements have been made in the Missouri River basin:

Miscellaneous discharge measurements in Missouri River basin.

Date.	Stream.	Locality.	Width.	Area of section.	Gage height.	Discharge.
1905.			*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 27	Missouri River	Buford (above mouth of Yellowstone River).	366	2,230	4.44	9,880
March 29	do	do	369	1,960	4.40	8,610
May 10	do	do	421	2,740	2.67	7,320
May 29	do	4 miles below Buford	732	7,190	3.69	26,500
1906.						
July 10	Sixteen Mile Creek	Lombard				20

SMITH RIVER DRAINAGE BASIN.

SMITH RIVER AT TRULY, MONT.

The gaging station was established March 7, 1905. It is located at a steel highway bridge on the county road running up Smith River Valley, in the center of sec. 35, T. 19 N., R. 2 E., Montana prime meridian, near the discontinued post-office of Truly and about 20 miles southwest of Great Falls, Mont., whence it is reached by driving. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 36.

Discharge measurements of Smith River at Truly, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 9	Morse and Edson	99	164	2.37	423
May 21	G. Edson	99	152	2.32	397
July 12	R. Richards	99	163	2.31	317
November 28 [a]	do	[a] 65	[a] 50	1.60	80

[a] Wading section.

Daily gage height, in feet, of Smith River at Truly, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Oct.	Nov.	Dec.
1	1.35	1.52	1.62	2.70	1.95	3.20	2.98	1.50	1.60	1.42
2	1.35	1.45	1.55	2.65	1.95	3.10	2.90	1.60	1.60	1.45
3	1.35	1.42	1.47	2.35	2.00	3.12	2.75	1.60	1.60	1.42
4	1.40	1.45	1.47	2.15	2.08	3.05	2.60	1.60	1.62	1.50
5	1.40	1.42	1.55	2.10	2.08	3.00	2.45	1.58	1.65	1.58
6	1.55	1.42	1.55	2.10	2.00	3.40	2.45	1.62	1.60	1.78
7	1.52	1.40	1.57	2.12	1.95	3.98	2.40	1.60	1.60	1.88
8	1.27	1.47	1.55	2.22	1.95	3.85	2.35	1.60	1.62	1.85
9	1.55	1.45	1.47	2.35	1.95	3.75	2.35	1.58	1.62	1.78
10	1.52	1.55	1.55	2.40	1.90	3.75	2.35	1.50	1.60	1.82
11	1.60	1.45	1.50	2.27	1.90	3.80	2.38	1.60	1.65	1.82
12	1.55	1.45	1.37	2.30	1.92	3.80	2.25	1.55	1.65	1.78
13	1.60	1.57	1.37	2.10	2.08	3.75	2.25	1.60	1.62	1.80
14	1.50	1.45	1.47	2.15	2.12	3.90	2.25	1.60	1.60	1.72
15	1.30	1.50	1.55	2.12	2.30	3.75	2.25	1.55	1.62	1.70
16	1.42	1.50	1.60	2.00	2.50	3.68	2.25	1.60	1.60	1.68
17	1.35	1.55	1.65	2.00	2.48	3.50	2.18	1.60	1.82	1.68
18	1.45	1.55	1.70	2.00	2.28	3.38	2.15	1.60	1.75	1.65
19	1.35	1.55	1.77	2.05	2.28	3.15	2.10	1.60	1.58	1.70
20	1.50	1.55	1.77	2.05	2.35	3.15	2.08	1.60	1.42	1.70
21	1.45	1.50	1.75	2.05	2.52	3.10	1.95	1.50	1.32	1.72
22	1.45	1.55	1.80	2.10	2.58	3.00	1.95	1.60	1.38	1.78
23	1.45	1.55	1.72	2.10	2.58	3.32	1.95	1.60	1.40	1.75
24	1.62	1.55	1.77	2.40	2.60	3.60	1.85	1.55	1.35	1.68
25	1.65	1.57	2.20	2.40	2.52	3.55	1.85	1.60	1.32	1.70
26	1.62	1.57	2.12	2.40	2.60	3.55	1.78	1.60	1.38	1.75
27	1.70	1.60	2.62	2.35	2.60	3.52	1.75	1.60	1.35	[a] 2.22
28	1.72	1.62	2.90	2.22	2.72	3.58	1.75	1.62	1.40	2.20
29	1.65	.....	2.77	2.20	2.98	3.60	1.60	1.60	1.45	1.95
30	1.52	.....	2.55	2.00	3.28	3.55	1.45	1.60	1.45	1.78
31	1.55	.....	2.47	.....	3.25	.....	1.45	1.60	.....	1.58

[a] Ice gorge.

NOTE.—Ice conditions January 15–30, February 4–20, and March 12–23; also November 19–December 1, December 13–21, 30, 31. Station temporarily discontinued August 1 to September 30.

SUN RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Sun River rises on the eastern slope of the Rocky Mountains in northwestern Montana, flows southward for about 60 miles, then, turning abruptly, flows eastward through a canyon in the confining mountains, emerging on a level plain through which it runs for 75 miles to its junction with the Missouri at Great Falls. The basin lies between Teton River on the north, the Dearborn on the south, the Missouri on the east, and the crest of the main range of the Rockies on the west.

NORTH FORK OF SUN RIVER NEAR AUGUSTA, MONT.

This station was established October 31, 1903. It is located below the head of the Kilraven ditch, near Christian's ranch, 14 miles northwest of Augusta and 21 miles southwest of Chouteau, Mont. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 38, where are given also references to publications that contain data for previous years.

Discharge measurements of North Fork of Sun River near Augusta, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 12	H. M. Morse	108	291	0.85	277
May 7	G. Edson	126	411	1.81	889
May 27	do	135	438	2.10	1,160
June 21	Edson and Richards	131	445	2.07	1,080
July 19	R. Richards	112	340	1.30	491
August 16	do	100	278	.78	280
October 4	do	105	266	.73	225
November 14	Follansbee and Richards	120	351	1.40	508

Daily gage height, in feet, of North Fork of Sun River near Augusta, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.7	1.8	2.2	2.0	1.0	1.0	0.7	1.1	1.0
2	.7	1.7	2.3	1.9	1.0	1.0	.7	1.1	1.0
3	.8	1.7	2.3	1.9	1.0	1.0	.7	1.1	1.1
4	.8	1.7	2.8	1.9	1.0	.9	.7	1.1	1.2
5	.8	1.7	3.1	1.9	1.0	.8	.7	1.0	1.2
6	.8	1.8	2.8	1.8	1.0	.8	.7	1.0	1.2
7	.8	1.8	2.7	1.8	1.0	.8	.7	1.0	1.2
8	.8	1.8	2.7	1.7	.9	.8	.6	1.0	1.1
9	.9	1.8	2.6	1.7	.9	.8	.6	1.0	1.1
10	.9	1.9	2.6	1.6	.9	.8	.6	1.0	1.1
11	1.0	2.0	2.6	1.6	.9	.8	.6	1.0	1.1
12	1.0	2.5	2.9	1.5	.9	.8	.6	1.0	1.0
13	1.0	2.7	3.1	1.5	.9	.8	.6	1.2	1.0
14	1.1	2.7	2.8	1.6	.8	.8	.6	1.4	1.0
15	1.2	2.6	2.6	1.5	.8	.8	.6	1.6	1.0

Daily gage height, in feet, of North Fork of Sun River near Augusta, Mont., for 1905—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	1.2	2.4	2.5	1.5	0.8	0.8	0.6	2.5	1.0
17	1.3	2.2	2.5	1.4	.7	.8	.6	2.0	1.1
18	1.4	2.0	2.4	1.4	.7	.8	.6	1.6	1.1
19	1.4	2.0	2.2	1.4	.7	.8	.6	1.6	1.1
20	1.5	2.0	2.1	1.3	.7	.8	.6	1.6	1.1
21	1.5	2.1	2.1	1.2	.7	.8	.6	1.6	1.0
22	1.5	2.2	2.0	1.2	.8	.8	.6	1.5	1.0
23	1.6	2.2	2.0	1.2	.9	.8	.8	1.5	1.0
24	1.7	2.2	2.0	1.2	1.0	.8	1.0	1.4	1.0
25	1.8	2.2	2.0	1.2	1.0	.8	1.1	1.4	1.0
26	1.8	2.2	2.0	1.1	1.1	.7	1.2	1.3	1.0
27	1.9	2.1	2.0	1.1	1.2	.7	1.2	1.3	1.0
28	1.8	2.1	2.2	1.1	1.3	.7	1.2	1.2	1.0
29	1.8	2.2	2.2	1.1	1.2	.7	1.2	1.1	1.0
30	1.8	2.2	2.0	1.1	1.2	.7	1.1	1.0	1.0
31	.....	2.2	.....	1.0	1.1	.....	1.1	.....	1.0

NOTE.—Practically open-channel conditions during December.

Rating table for North Fork of Sun River near Augusta, Mont., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.60	195	1.30	485	2.00	1,020	2.60	1,670
.70	225	1.40	545	2.10	1,120	2.70	1,790
.80	260	1.50	610	2.20	1,220	2.80	1,920
.90	295	1.60	680	2.30	1,330	2.90	2,050
1.00	335	1.70	755	2.40	1,440	3.00	2,180
1.10	380	1.80	835	2.50	1,550	3.10	2,320
1.20	430	1.90	925				

NOTE.—The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1906, and is well defined.

Monthly discharge of North Fork of Sun River near Augusta, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	925	225	493	29,300
May	1,790	755	1,120	68,900
June	2,320	1,020	1,470	87,500
July	1,020	335	609	37,400
August	485	225	315	19,400
September	335	225	263	15,600
October	430	195	257	15,800
November	1,550	335	519	30,900
December	430	335	360	22,100
The period	.....	.....	.....	327,000

NOTE.—Values for 1906 are excellent.

SOUTH FORK OF SUN RIVER AT AUGUSTA, MONT.

This station was established December 2, 1904. It is located at the highway bridge on the road from Augusta to Craig, Mont., about one-half mile from Augusta. A small diversion dam immediately below the bridge affected the gage height, as the dam was frequently changed during the irrigation season. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 40, where are given also references to publications that contain data for previous years.

Discharge measurements of South Fork of Sun River at Augusta, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 11	Morse and Edson	30	41	0.91	29.0
April 13	do	29	39	.90	28.7
May 4	G. Edson	30	41	.90	33.0
May 25	do	35	60	1.56	160
May 26	do	38	73	1.80	294
May 28	do	38	76	1.85	314
May 29	do	82	134	2.39	565
June 20	Edson and Richards	32	61	1.36	156
July 17	R. Richards	30	40	.82	27.0
August 15	do	[a] 15	[a] 6.4	.54	4.8
October 3	do	[a] 25	[a] 37	.92	25.0
November 13	Follansbee and Richards	[a] 32	[a] 40	1.01	25.3

[a] Wading section.

Daily gage height, in feet, of South Fork of Sun River at Augusta, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.5	1.0	1.2	1.1	0.9	2.5	1.0	0.7	1.0	0.9	1.0	1.1
2	1.5	1.0	1.2	1.0	.9	2.5	1.0	.7	1.0	.9	1.0	1.1
3	1.5	1.0	1.2	1.0	.9	2.5	.9	.7	1.0	.9	1.0	1.1
4	1.6	1.0	1.1	1.0	.9	2.5	.8	.7	1.0	.9	1.0	1.1
5	1.6	1.0	1.1	.9	.9	2.4	.7	.6	.9	.9	1.0	1.1
6	1.7	1.0	1.2	9	.9	2.3	.7	.6	.9	.9	1.0	1.1
7	1.7	1.0	1.2	.95	.9	2.2	.6	.6	.9	.9	1.0	1.1
8	1.7	1.0	1.2	.95	.9	2.1	.6	.6	.9	.9	1.0	1.1
9	1.7	1.2	1.2	.95	.9	1.9	.5	.6	.9	.9	1.0	1.1
10	1.7	1.2	1.2	.9	.9	1.8	.4	.6	.9	.9	1.0	1.1
11	1.7	1.2	1.3	.9	.9	1.8	.4	.6	.9	.9	1.0	1.2
12	1.8	1.3	1.3	.9	.8	1.7	.4	.6	.9	.9	1.0	1.1
13	1.8	1.3	1.3	.9	.8	1.6	.4	.6	1.0	.9	1.0	1.0
14	1.8	1.3	1.3	.9	.8	1.5	.8	.6	1.0	.9	1.0	1.0
15	1.8	1.3	1.3	.9	.7	1.4	.8	.6	1.0	.9	1.0	1.0
16	1.8	1.3	1.3	.9	.7	1.4	.8	.6	1.0	.9	1.0	1.0
17	1.8	1.3	1.3	.9	.7	1.4	.8	.5	.9	1.0	1.0	1.0
18	1.8	1.3	1.3	.9	.7	1.4	.8	.5	.9	1.0	1.1	1.0
19	1.8	1.3	1.3	.8	.7	1.4	.9	.5	1.0	1.0	1.1	1.0
20	1.8	1.3	1.3	.8	.8	1.4	.9	.5	1.0	1.0	1.1	1.0
21	1.8	1.3	1.3	.8	.8	1.4	.9	.5	1.0	1.0	1.1	1.0
22	1.8	1.3	1.3	.85	.9	1.3	1.0	.6	1.0	1.0	1.1	1.0
23	1.8	.9	1.3	.85	1.0	1.3	1.0	1.1	.9	1.0	1.1	1.0
24	1.8	.9	1.1	.85	1.0	1.3	1.0	1.1	.9	1.0	1.1	1.0
25	1.8	1.1	1.1	.85	1.4	1.2	1.0	1.1	.9	1.0	1.1	1.0
26	1.0	1.1	1.1	.85	1.1	1.2	.9	1.1	.9	1.0	1.1	1.0
27	1.0	1.1	1.1	.85	2.0	1.2	.9	1.1	.9	1.0	1.1	1.0
28	1.0	1.1	1.1	.9	2.4	1.1	.8	1.0	.9	1.0	1.1	1.0
29	1.0	.....	1.1	.9	2.5	1.1	.8	1.0	.9	1.0	1.1	1.0
30	1.0	.....	1.1	.9	2.5	1.1	.8	1.0	.9	1.0	1.1	1.0
31	1.0	.....	1.1	.....	2.5	.....	.8	1.0	.....	1.0	.....	1.0

NOTE.—Ice conditions during the greater part of January, February, and March, and December 24-31; gage heights are to top of ice.

Monthly discharge of South Fork of Sun River at Augusta, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
February	53	30	41.1	2,280
March	69	53	63.8	3,920
April	53	23	30.8	1,830
May	625	18	119	7,320
June	625	95	277	16,500
July	78	17	32.1	1,970
August	41	3	15.6	959
September	31	23	26.2	1,560
October	31	23	25.7	1,580
November	33	25	28.5	1,700
December	42	25	28.4	1,750
The period				41,400

NOTE.—Values are rated as follows: April, fair; May, good; the remainder of the period, approximate, owing to the instability of a small diversion dam below the station or to ice conditions.

SUN RIVER AT SUN RIVER, MONT.

This station was established July 31, 1905. It is located at the highway bridge at Sun River, Mont., 21 miles west of Great Falls, and is used to check the measurements of the river and the ditches above. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 42.

Discharge measurements of Sun River at Sun River, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 10	Morse and Edson	87	150	2.28	344
April 15	H. M. Morse	85	147	2.24	359
May 3	G. Edson	112	252	3.07	684
May 11	do	136	345	3.85	1,240
May 22	do	135	335	3.80	1,160
May 30	do	220	595	4.95	2,140
June 19	Edson and Richards	166	464	4.29	1,510
July 16	R. Richards	95	217	2.70	506
August 17	do	[a] 52	[a] 39.2	1.49	74
October 16	do	[a] 56	[a] 61.7	1.89	204
November 6	Follansbee and Richards	[a] 61	[a] 91.6	2.39	396
November 16	do	172	519	4.50	[b] 1,440

[a] Wading section. [b] Ice running, value doubtful.

Daily gage height, in feet, of Sun River at Sun River, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.0	2.5	2.0	2.2	3.0	4.85	3.4	1.95	2.0	1.8	2.3	3.6
2	2.0	2.1	2.0	2.3	3.0	4.8	3.3	1.95	2.0	1.83	1.9	3.6
3	2.0	2.1	2.0	2.2	3.0	4.75	3.3	1.95	1.95	1.85	.....	3.55
4	2.1	2.1	2.0	2.15	3.6	4.85	3.2	1.8	1.8	1.9	2.4	3.53
5	2.1	2.0	2.0	2.1	3.8	5.8	3.5	1.8	1.8	1.9	2.4	3.6
6	2.1	2.0	2.0	2.1	3.6	5.55	3.0	1.8	1.8	1.9	2.42	3.6
7	2.0	2.0	2.0	2.1	3.4	5.25	2.95	1.8	1.6	1.9	2.41	3.61
8	2.0	2.0	2.0	2.15	3.35	5.0	3.0	1.8	1.6	1.9	2.5	3.15
9	2.0	2.1	2.0	2.2	3.2	4.9	3.0	1.75	1.55	1.87	2.51	3.15
10	2.0	2.1	2.0	2.25	3.1	4.65	2.95	1.75	1.5	1.88	2.5	3.14
11	2.0	2.1	1.9	2.25	3.85	4.9	2.95	1.7	1.5	1.93	2.5	3.14
12	2.0	2.2	1.85	2.1	4.4	5.2	3.0	1.65	1.4	1.99	2.4	3.1
13	2.0	2.2	1.8	2.5	4.95	5.45	3.0	1.65	1.4	1.97	2.4	3.5
14	2.0	2.1	1.7	2.0	4.6	5.0	3.0	1.6	1.3	1.9	2.8	3.2
15	2.0	2.1	1.7	2.3	4.75	4.75	2.85	1.6	1.6	1.9	2.9	3.2

Daily gage height, in feet, of Sun River at Sun River, Mont., for 1906—Continued.

Days.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	2.0	2.2	1.7	2.25	4.45	4.65	2.7	1.5	1.5	1.8	4.5	3.2
17	2.0	2.2	2.2	2.4	4.1	4.6	2.7	1.5	1.65	1.8	4.2	3.2
18	2.0	2.0	2.3	2.6	3.95	4.25	2.7	1.5	1.65	1.83	4.1	3.2
19	2.0	2.0	2.3	2.6	3.8	4.15	2.65	1.45	1.65	1.87	4.1	3.0
20	2.0	2.0	2.25	2.65	3.85	3.85	2.5	1.45	1.7	1.88	3.82	3.0
21	2.5	2.1	2.4	2.75	3.85	3.8	2.45	1.45	1.8	1.88	3.81	3.0
22	2.85	2.1	2.4	3.5	3.85	3.75	2.45	1.45	1.8	1.86	3.8	3.0
23	2.8	2.1	2.4	3.4	3.95	3.7	2.25	1.8	1.8	1.83	3.9	3.0
24	2.8	2.1	2.4	3.8	3.85	3.8	2.2	1.95	1.6	1.9	3.92	3.5
25	2.8	2.0	3.0	3.9	4.0	3.75	2.2	2.1	1.7	1.9	3.72	3.5
26	2.4	2.0	2.95	3.6	4.15	3.7	2.2	2.4	1.5	1.9	3.95	3.2
27	2.4	2.0	2.95	3.45	4.2	3.6	2.2	2.4	1.6	2.0	3.97	3.2
28	2.4	2.0	2.8	3.3	4.15	3.6	2.15	2.4	1.6	2.0	4.0	3.2
29	2.4	.....	2.8	3.0	5.55	3.75	2.15	2.3	1.65	2.0	3.98	3.2
30	2.1	.....	2.7	3.0	4.95	3.75	2.0	2.3	1.7	2.0	3.9	3.4
31	2.1	.....	2.5	.....	4.6	.....	1.95	2.0	.....	2.1	.....	3.5

NOTE.—Ice conditions January 12–28, February 4–12, March 3, 11–28; the ice increased in thickness from 0.2 foot January 13 to 1 foot March 11.

Rating table for Sun River at Sun River, Mont., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	47	2.40	386	3.50	938	4.60	1,795
1.40	70	2.50	428	3.60	1,000	4.70	1,885
1.50	94	2.60	470	3.70	1,065	4.80	1,980
1.60	119	2.70	514	3.80	1,135	4.90	2,075
1.70	146	2.80	560	3.90	1,210	5.00	2,170
1.80	175	2.90	608	4.00	1,285	5.20	2,370
1.90	206	3.00	658	4.10	1,365	5.40	2,575
2.00	238	3.10	710	4.20	1,445	5.60	2,785
2.10	272	3.20	764	4.30	1,530	5.80	3,000
2.20	308	3.30	820	4.40	1,615		
2.30	346	3.40	878	4.50	1,705		

NOTE.—The above table is applicable only for open-channel conditions. It is based on fourteen discharge measurements made during 1905–6 and is well defined above gage height 1.7 feet. Below 1.7 feet the table is based on two discrepant measurements, and at gage heights 1.3 feet is only approximate.

Monthly discharge of Sun River at Sun River, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January (1–11; 30–31)	272	238	251	6,470
February	428	238	269	14,900
March (1–10; 28–31)	560	238	317	8,800
April	1,210	238	516	30,700
May	2,730	658	1,310	80,600
June	3,000	1,000	1,730	103,000
July	938	222	533	32,800
August	386	82	190	11,700
September	238	47	137	8,150
October	272	175	207	12,700
November	1,700	206	837	49,800
The period	.....	.....	.....	360,000

No estimate for ice period.

NOTE.—Values are rated as follows: January to October, excellent; the mean discharge value for November may be high on account of ice gorging, but it can probably be considered good.

WILLOW CREEK NEAR AUGUSTA, MONT.

The gaging station was established June 8, 1905. It is located at Jordan's ranch, just below the junction of Willow Creek with Little

Willow Creek, about 8 miles northwest of Augusta, Mont., in sec. 27, T. 21 N., R. 7 W., from which it is reached by driving. The conditions at this station and the bench marks are described in Water Supply Paper No. 172, page 43. The length of chain is now 13.95 feet.

Discharge measurements of Willow Creek River near Augusta, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 8	Porter and Casen	13	38	2.12	58
July 13	A. P. Porter	17	12	1.19	23
August 22	Porter and Edson	16	8	.95	12
November 2	Gordon Edson	14	4	.61	3
1906.					
April 11	Morse and Edson	11	18.7	.77	10.8
May 7	G. Edson	14	4.6	.55	5.3
May 27	do	11	25.2	1.48	33.0
May 29	do	15	59.1	3.46	115
June 21	Edson and Richards	11	25.6	1.03	16.4
July 18	R. Richards	11	21.4	.87	13.5
August 16	do	16	7.5	.55	5.90
October 4	do	12	6.5	.59	7.8
November 15	Follansbee and Richards	13	8.2	.82	11.6

NOTE.—These measurements were made at different sections.

Daily gage height, in feet, of Willow Creek River near Augusta, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.58	0.68	0.60	1.08	0.60	1.85	0.75	0.50	0.80	0.60	0.62	0.85
2	.58	.68	.60	.98	.52	1.78	.75	.50	.80	.60	.62	.85
3	.58	.68	.58	.80	.50	1.82	.75	.50	.78	.60	.62	.85
4	.58	.52	.60	.80	.55	2.02	.75	.55	.78	.58	.62	.88
5	.58	.55	.72	.80	.62	2.02	.65	.55	.78	.58	.62	.90
6	.60	.60	.70	.85	.60	2.05	.60	.60	.75	.58	.65	.90
7	.60	.62	.82	.85	.55	1.90	.52	.60	.72	.55	.75	1.15
8	.60	.62	.82	.82	.55	1.70	.52	.60	.70	.62	.75	.90
9	.62	.62	.62	.80	.55	1.65	.52	.60	.70	.62	.70	.65
10	.62	.62	.42	.78	.50	1.75	.50	.60	.70	.62	.70	.65
11	.62	.60	.42	.80	.50	1.70	.50	.58	.70	.62	.68	.70
12	.62	.60	.42	.80	.50	1.62	.50	.58	.75	.62	.68	.70
13	.62	.60	.42	.75	.50	1.60	.52	.60	.75	.62	.68	.90
14	.62	.60	.45	.75	.50	1.60	.52	.60	.78	.62	.70	.85
15	.62	.62	.45	.70	.58	1.60	.62	.58	.80	.62	.70	.70
16	.62	.62	.45	.70	.50	1.55	.72	.55	.75	.62	.80	.65
17	.60	.62	.45	.70	.48	1.48	.72	.55	.70	.65	.88	.80
18	.60	.68	.50	.70	.45	1.28	.72	.55	.70	.65	.82	.80
19	.60	.70	.50	.70	.40	1.22	.65	.55	.70	.65	.70	.80
20	.60	.70	.50	.70	.42	1.00	.62	.58	.70	.70	.78	.80
21	.60	.68	.50	.70	.48	1.00	.55	.58	.70	.62	.80	.80
22	.58	.65	.52	.62	.52	1.05	.55	.72	.68	.68	.80	.80
23	.60	.62	.52	.62	.70	1.00	.52	1.22	.68	.68	.80	.82
24	.70	.60	.60	.65	1.10	1.00	.52	.90	.62	.88	.80	.85
25	.68	.60	.70	.65	1.32	.85	.50	.85	.62	.85	.90	.85
26	.65	.60	.82	.65	1.85	.82	.48	.82	.62	.82	.90	.85
27	.62	.60	1.12	.65	1.55	.77	.48	.80	.62	.72	.90	.85
28	.62	.60	1.22	.65	1.60	.77	.48	.80	.60	.70	.85	.85
29	.65	.....	1.20	.62	3.10	.75	.48	.80	.60	.65	.80	.78
30	.68	.....	1.05	.60	2.45	.75	.58	.80	.60	.62	.85	.75
31	.68	.....	1.05	.....	2.08	.....	.55	.80	.....	.62	.....	.70

NOTE—No ice conditions near the gage due to the effect of springs. The stream was frozen over several hundred feet downstream, but it is considered this will not affect the flow at the gage.

Rating table for Willow Creek River near Augusta, Mont., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.40	4	1.30	26	2.20	59	3.10	94
.50	5	1.40	29	2.30	63	3.20	98
.60	7	1.50	33	2.40	67	3.30	102
.70	9	1.60	37	2.50	70	3.40	106
.80	11	1.70	40	2.60	74	3.50	110
.90	14	1.80	44	2.70	78	3.60	114
1.00	17	1.90	48	2.80	82		
1.10	20	2.00	51	2.90	86		
1.20	23	2.10	55	3.00	90		

NOTE.—The above table is applicable only for open channel conditions. It is based on eleven discharge measurements made during 1905 and 1906 and is well defined between gage heights 0.5 foot and 1.5 feet. Above 1.5 feet the curve depends on two measurements.

Monthly discharge of Willow Creek near Augusta, Mont., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
June (8–30)	103	27	58.1	2,650
July	72	9	25.8	1,590
August	53	12	18.7	1,150
September	12	3	7.7	458
October	8	3	4.8	295
November	9	3	6.2	369
December	8	3	5.6	344
The period				6,860
1906.				
January	9	7	7.3	449
February	9	5	7.4	411
March	24	4	8.8	541
April	19	7	10.0	595
May	94	4	16.4	1,010
June	53	10	30.5	1,810
July	10	5	6.6	406
August	24	5	8.4	516
September	11	7	9.1	542
October	13	6	7.9	486
November	14	7	10.1	601
December	21	8	11.5	707
The year	94	4	11.2	8,070

NOTE.—Values are rated as follows: June to August, 1905, and July, 1906, good; September, 1905, to March, 1906, approximate, owing to insufficient data; April to June, November, and December, 1906, excellent; August to October, 1906, fair.

FORD CREEK, NEAR AUGUSTA, MONT.

The gaging station was established April 11, 1906. It is located at the ranch of Joseph Ford, 16 miles west of Augusta, and a short distance below the heading of a small irrigation ditch. No regular observations are made of the flow of this ditch, but occasional measurements are made.

The channel is straight for 50 feet above and below the section. The right bank is low, covered with dense brush, and liable to overflow; the left is high, nearly clear, and will not overflow. The bed is rocky and permanent and the current is swift.

Discharge measurements are made from a footbridge near by or by wading.

The gage, which is read twice each day by Joseph Ford, is a staff fastened to a post on the left bank of the stream in front of the observer's house. The bench mark is a spike in the root of a cottonwood tree, 15 feet east of the gage; elevation 5.89 feet above the gage datum.

Discharge measurements of Ford Creek near Augusta, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 14	H. M. Morse	12	6.5	0.99	10.2
May 5	G. Edson	12	7.6	1.01	12.0
May 25	do	14	11.5	1.42	39.9
June 21	Edson and Richards	15	11.1	1.38	35.6
July 18	R. Richards	15	10.1	1.28	26.8
August 16	do	14	9.0	1.07	15.0
October 4	do	13	7.6	.98	11.8
November 14	Follansbee and Richards	14	8.5	1.16	19.3

Daily gage height, in feet, of Ford Creek near Augusta, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.1	1.8	1.3	1.0	1.05	1.0	1.0	1.2
2		1.1	1.8	1.3	1.0	1.1	1.0	.0	1.2
3		1.1	1.8	1.3	1.0	1.1	1.0	.0	1.2
4		1.05	1.7	1.25	1.0	1.1	1.0	1.1	1.2
5		1.0	1.7	1.2	1.0	1.1	1.0	1.1	1.2
6		1.0	1.7	1.2	1.0	1.1	1.0	1.1	1.2
7		1.0	1.6	1.2	1.0	1.1	1.0	1.1	1.2
8		1.0	1.5	1.2	1.05	1.1	1.0	1.1	1.5
9		1.0	1.5	1.2	1.1	1.05	1.0	1.15	2.0
10		1.0	1.5	1.2	1.1	1.0	1.0	1.1	2.0
11		1.0	1.5	1.2	1.1	1.0	1.0	1.1	2.0
12		1.0	1.5	1.2	1.1	1.0	1.0	1.1	2.0
13		1.0	1.5	1.2	1.1	1.0	1.0	1.15	2.0
14	1.0	1.0	1.45	1.2	1.1	1.0	1.0	1.2	1.5
15	1.0	1.0	1.4	1.2	1.1	1.0	1.0	1.35	1.2
16	1.0	1.0	1.4	1.2	1.0	1.0	1.0	1.45	1.2
17	1.1	1.0	1.4	1.2	1.0	1.0	1.0	1.5	1.2
18	1.1	1.0	1.4	1.3	1.0	1.0	1.0	1.4	1.2
19	1.05	1.0	1.4	1.3	1.0	1.0	1.0	1.4	1.2
20	1.05	1.0	1.4	1.3	1.0	1.0	1.0	1.35	1.2
21	1.05	1.0	1.4	1.3	1.15	1.0	1.0	1.3	1.1
22	1.1	1.0	1.4	1.3	1.3	1.0	1.0	1.3	1.1
23	1.1	1.1	1.4	1.25	1.35	1.0	1.0	1.3	1.1
24	1.1	1.25	1.3	1.2	1.25	1.0	1.0	1.3	1.1
25	1.1	1.4	1.3	1.2	1.2	1.0	1.0	1.2	1.1
26	1.1	1.5	1.3	1.2	1.1	1.0	1.1	1.25	1.1
27	1.1	1.5	1.3	1.2	1.1	1.0	1.1	1.2	1.1
28	1.1	1.5	1.3	1.2	1.1	1.0	1.1	1.2	1.1
29	1.1	1.6	1.3	1.2	1.1	1.0	1.1	1.2	1.1
30	1.1	1.6	1.3	1.1	1.1	1.0	1.1	1.2	1.1
31		1.6		1.0	1.1		1.1		1.5

NOTE.—From August 8 to 15, inclusive, the water was shut off from the irrigation ditch immediately above the gage. November 2 and 3 the entire flow of the creek was turned into the irrigation ditch. Backwater from ice gorge December 8-14, 31; discharge estimated.

Rating table for Ford Creek near Augusta, Mont., from April 15 to December 31, 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	8	1.20	21	1.50	48	1.80	93
1.00	12	1.30	28	1.60	61		
1.10	16	1.40	37	1.70	76		

NOTE.—The above table is applicable only for open channel conditions. It is based on eight discharge measurements made during 1906 and is well defined between gage heights 1.0 foot and 1.4 feet.

Monthly discharge of Ford Creek near Augusta, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet
	Maximum.	Minimum.	Mean.	
April (14-30)	16	12	14.9	503
May	61	12	22.0	1,350
June	93	28	47.6	2,830
July	28	12	22.5	1,380
August	32	12	15.8	972
September	16	12	13.1	780
October	16	12	12.8	787
November	48	0	22.2	1,320
December	21	16	19.2	1,180
The period				11,100

NOTE.—Values for 1906 are excellent.

SMITH CREEK NEAR AUGUSTA, MONT.

The gaging station was established April 14, 1906, at J. W. Nixon's ranch, 16 miles southwest of Augusta. It is located 1 mile above Mr. Nixon's house.

The channel curves above the station, but is straight for 100 feet below. The right bank is high and will not overflow; the left is low and will overflow at high stage. The bed is rocky and permanent and the current is swift. At low water the stream sinks entirely into the gravel 1 mile below the station and reappears 1 mile farther down. It has not been definitely determined as yet whether the entire flow reappears.

Discharge measurements are made by wading near the station.

The gage, which is read daily by Mrs. J. W. Nixon, consists of an inclined rod securely fastened to a rock ledge, which is located at the ford on the road to White Sawmill. The gage is referred to a bench mark, which is a roughly chipped square on the point of the ledge; elevation, 4.09 feet above the gage datum.

Discharge measurements of Smith Creek near Augusta, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 14	Morse and Edson	12	8.2	0.95	14.2
May 5	G. Edson	16	12.5	1.00	19.5
May 25	do	26	29.7	1.42	82.4
June 21	Edson and Richards	20	22.2	1.18	43.0
July 18	R. Richards	14	12.1	1.01	22.8
August 15	do	14	9.5	.89	12.2
October 3	do	14	9.0	.89	10.8
November 13	Follansbee and Richards	17	17.2	1.01	22.8

NOTE.—These measurements were made at different sections.

Daily gage height, in feet, of Smith Creek near Augusta, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.0	1.7	1.1	0.95	0.85	0.9	0.9	1.0
2	.....	1.0	1.75	1.1	.95	.85	.9	.9	1.0
3	.....	1.0	1.8	1.1	.95	.85	.9	.9	1.0
4	.....	1.0	1.8	1.05	.95	.85	.9	.9	.95
5	.....	1.0	1.6	1.05	.95	.85	.9	.9	.95
6	.....	1.0	1.6	1.05	.95	.85	.9	.9	.95
7	.....	1.0	1.55	1.05	.95	.85	.9	.9	.9
8	.....	1.0	1.5	1.05	.95	.85	.9	.9	.9
9	.....	1.0	1.4	1.05	.95	.8	.9	.9	.9
10	.....	1.0	1.45	1.05	.9	.8	.9	.9	.9
11	.....	1.0	1.45	1.05	.9	.8	.9	.9	.9
12	.....	1.0	1.35	1.05	.9	.8	.9	.9	.9
13	.....	1.0	1.35	1.05	.9	.8	.9	1.0	.9
14	.....	1.0	1.3	1.05	.9	.8	.9	1.0	.9
15	.....	1.05	1.3	1.05	.9	.8	.9	1.0	.9
16	1.0	1.1	1.25	1.0	.9	.8	.9	1.1	.9
17	1.0	1.0	1.25	1.0	.9	.85	.9	1.1	.9
18	1.0	1.05	1.2	1.0	.9	.85	.9	1.1	.9
19	1.0	1.0	1.2	1.0	.9	.9	.9	1.1	.9
20	1.0	1.05	1.2	1.0	.9	.9	.9	1.05	.9
21	1.05	1.05	1.2	1.0	.95	.9	.9	1.05	.9
22	1.1	1.05	1.2	1.0	1.0	.9	.9	1.0	.9
23	1.05	1.1	1.15	1.0	1.1	.9	.9	1.0	.9
24	1.2	1.25	1.15	1.0	1.0	.9	1.0	1.0	.9
25	1.05	1.5	1.15	.95	1.05	.9	1.0	1.0	.9
26	1.0	1.5	1.15	.95	1.0	.9	1.0	1.0	.9
27	1.0	1.5	1.15	.95	.95	.9	1.0	1.0	.9
28	1.05	1.5	1.15	.95	.95	.9	.9	1.0	.9
29	1.0	1.6	1.15	.95	.95	.9	.9	1.0	.9
30	1.0	1.5	1.15	.95	.9	.9	.9	1.0	.9
31	.....	1.6	.....	.95	.9	.....	.9	.....	.9

NOTE.—The creek does not freeze over for several hundred yards above and below the gage.

Rating table for Smith Creek near Augusta, Mont., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	6	1.10	31	1.40	79	1.70	148
.90	12	1.20	45	1.50	100	1.80	175
1.00	20	1.30	61	1.60	123		

NOTE.—The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1906, and is well-defined between gage heights 0.9 foot and 1.4 feet.

Monthly discharge of Smith Creek near Augusta, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April (16-30)	45	20	23.9	711
May	123	20	42.5	2,610
June	175	38	75.7	4,500
July	31	16	22.1	1,360
August	31	12	15.5	953
September	12	6	9.4	559
October	20	12	13.0	799
November	31	12	18.6	1,110
December	20	12	13.2	812
The period	.....	.....	.....	13,400

NOTE.—Values for 1906 are excellent.

BELT CREEK DRAINAGE BASIN.

BELT CREEK NEAR BELT, MONT.

This station was established March 18, 1905. It is located at the highway bridge near Belt, Mont., in the NW. ¼, NE. ¼, sec. 18, T. 20 N., R. 7 E., 20 miles east of Great Falls, from which it is reached by driving. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 45. The length of the chain is now 16.75 feet.

Discharge measurements of Belt Creek near Belt, Mont., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 17	Porter and Bird	40	45	1.59	8.0
May 12	L. R. Stockman	40	47	1.61	7.8
June 11	A. P. Porter	55	160	3.85	578
1906.					
April 20	G. Edson	15	5.4	1.58	4.6
May 18	do	53	99	2.73	160
May 19	do	53	98	2.70	155
June 1	do	55	121	3.20	357
July 14	R. Richards	52	109	2.82	190
November 10	Follansbee and Richards	24	10	1.49	3.6

Daily gage height, in feet, of Belt Creek near Belt, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.1	1.4	1.7	1.93	1.93	3.2	4.0	2.0	1.7	0.9	1.0	.....
2	1.1	1.4	1.7	1.93	1.93	3.2	3.8	2.0	1.6	.9	1.0	2.0
3	1.1	1.4	1.8	1.93	1.93	3.2	3.7	2.0	1.5	1.0	1.0	1.9
4	1.1	.....	1.7	1.73	1.93	3.1	3.5	2.0	1.4	1.0	1.0	1.9
5	1.1	.....	1.7	1.73	1.93	4.1	3.5	1.8	1.4	1.0	1.1	1.9
6	1.1	.....	1.7	1.73	2.03	4.95	3.5	1.8	1.4	1.0	1.1	1.9
7	1.1	1.4	1.7	1.73	2.13	5.25	3.4	1.8	1.4	.8	1.5	1.9
8	1.1	1.4	1.8	1.73	2.03	4.2	3.3	1.8	1.3	.8	1.5	1.9
9	1.1	1.4	1.7	1.73	2.13	4.5	3.2	1.7	1.4	.8	1.5	1.9
10	1.1	1.4	1.7	1.73	2.13	4.4	3.0	1.7	1.4	.9	1.5	2.0
11	1.1	1.5	1.0	1.73	2.13	4.75	3.0	1.7	1.5	.9	1.5	.....
12	1.1	1.5	1.0	1.73	2.13	5.15	3.1	1.6	1.6	.9	1.5	.....
13	1.1	1.5	1.0	1.73	2.23	4.6	2.9	1.6	1.5	.9	1.5	.....
14	1.0	1.7	1.3	1.73	2.33	4.9	2.9	1.4	1.5	.9	1.5	.....
15	1.0	1.7	1.4	1.63	2.53	4.9	2.8	1.4	1.5	1.0	1.6	.....
16	1.1	1.7	1.4	1.63	2.53	4.9	2.8	1.4	1.4	1.0	1.6	.....
17	1.1	1.7	1.5	1.63	2.63	4.7	2.9	1.4	1.4	1.0	1.6	.....
18	.9	1.7	1.6	1.63	2.63	4.6	2.8	1.3	1.4	1.0	1.8	.....
19	.9	1.7	1.6	1.63	2.7	4.3	2.8	1.3	1.4	1.0	1.8	.....
20	.9	1.7	1.6	1.53	2.8	4.1	2.7	1.3	1.3	1.0	1.8	.....
21	.9	1.7	1.9	1.53	2.9	3.9	2.6	1.5	1.3	1.0	1.9	.....
22	.9	1.7	2.1	1.53	3.0	3.95	2.5	1.5	1.3	1.0	2.0	2.0
23	.9	1.7	2.1	1.53	3.0	3.9	2.5	1.5	1.2	1.0	2.0	.....
24	1.0	1.7	2.1	1.63	3.0	4.0	2.4	2.0	1.2	1.0	2.0	.....
25	1.0	1.7	2.1	1.73	3.0	4.1	2.3	2.1	1.1	1.0	2.0	.....
26	1.1	1.7	1.9	1.93	3.0	4.3	2.2	2.0	1.1	1.0	2.0	.....
27	1.1	1.7	1.9	1.93	3.0	4.3	2.2	1.8	1.1	1.0	2.0	2.0
28	1.4	1.7	1.9	1.93	3.2	4.3	2.2	1.8	1.1	1.0	2.0	.....
29	1.4	.....	1.9	1.93	3.4	4.3	2.1	1.8	1.0	1.0	2.0	1.8
30	1.4	.....	1.9	1.93	3.5	4.3	2.1	1.8	.9	1.0	2.0	.....
31	1.4	.....	1.9	.....	3.4	.....	2.1	1.8	.....	.....	.....	.....

NOTE.—Ice conditions January 1 to March 25, approximate. There was practically no flow from September 23 to November 7. Ice conditions November 17 to December 31; gage heights were to water surface.

Rating table for Belt Creek near Belt, Mont., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	0	2.30	73	3.40	387	4.40	863
1.30	1	2.40	90	3.50	429	4.50	918
1.40	2	2.50	109	3.60	472	4.60	974
1.50	4	2.60	130	3.70	516	4.70	1,031
1.60	7	2.70	154	3.80	561	4.80	1,089
1.70	12	2.80	181	3.90	607	4.90	1,149
1.80	19	2.90	211	4.00	655	5.00	1,210
1.90	27	3.00	243	4.10	705	5.10	1,272
2.00	36	3.10	276	4.20	756	5.20	1,335
2.10	46	3.20	311	4.30	809	5.30	1,399
2.20	58	3.30	348				

NOTE.—The above table is applicable only for open-channel conditions. It is based on nine discharge measurements made during 1905–6, and is fairly well defined between gage heights 1.5 feet and 4 feet.

Monthly discharge of Belt Creek near Belt, Mont., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
March (18–31)	7	5	6.3	175
April	10	5	7.3	434
May	90	7	24.8	1,520
June	705	109	341	20,300
July	243	27	109	6,700
August [a]	36	0	8.2	504
The period				29,600
1906.				
March (26–31)	27	27	27.0	321
April	30	5	16.0	952
May	429	30	150	9,220
June	1,370	276	818	48,700
July	655	46	231	14,200
August	46	1	16.3	1,000
September	12	0	2.3	137
October	0	0	0	0
November	7	0	3.1	105
The period				74,600

[a] Creek dry for remainder of year.

NOTE.—No estimates of accuracy can be made, as the gage heights are only approximate; the above results are liable to be considerably in error.

HIGHWOOD CREEK DRAINAGE BASIN.

HIGHWOOD CREEK NEAR HIGHWOOD, MONT.

The gaging station was established March 19, 1905, and was discontinued July 31, 1906. It is located at a highway bridge leading up Highwood Creek Valley, at Smith's ranch near Highwood, in sec. 5, T. 20 N., R. 8 E., Montana prime meridian, and 30 miles east of Great Falls, from which it is reached by driving. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 46.

Discharge measurements of Highwood Creek near Highwood, Mont., in 1905-6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq.-ft.*	*Feet.*	*Sec.-ft.*
1905.					
March 19	Porter and Bird	16	9	0.75	8.0
May 13	Stockman and Porter	16	9	.84	8.0
June 11	A. P. Porter	25	28	1.78	91
1906.					
April 21	G. Edson	16	10	.87	8.6
May 19	do	15	8	.80	5.7
June 1	do	18	24	1.65	103
July 13	R. Richards	18	19	1.21	22.0

Daily gage height, in feet, of Highwood Creek near Highwood, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	0.61	0.70	0.66	0.99	0.85	1.65	1.58
2	.61	.72	.68	.96	.79	1.62	1.52
3	.62	.75	.66	.95	.79	1.57	1.49
4	.61	.68	.65	.90	.81	1.47	1.44
5	.62	.74	.66	.90	.79	1.42	1.42
6	.61	.72	.66	.92	.79	3.75	1.38
7	.62	.71	.68	.99	.77	4.02	1.32
8	.61	.70	.68	1.02	.71	3.65	1.25
9	.62	.68	.68	.99	.69	3.25	1.22
10	.61	.68	.68	.96	.69	2.6	1.18
11	.62	.68	.68	.96	.71	2.25	1.20
12	.61	.65	.68	.94	76	2.2	1.18
13	.62	.68	.68	.90	.79	2.07	1.20
14	.61	.68	.70	.86	.80	1.9	1.18
15	.62	.66	.70	.86	.83	1.85	1.12
16	.61	.65	.70	.84	.83	1.8	1.08
17	.62	.64	.69	.84	.83	1.75	1.05
18	.61	.62	.70	.84	.83	1.65	1.05
19	.62	.61	.69	.84	.81	1.6	1.01
20	.61	.60	.70	.84	.82	1.55	0.99
21	.62	.60	.66	.84	.89	1.52	.96
22	.61	.62	.68	.86	.95	1.6	.93
23	.62	.64	.66	.87	.95	1.9	.98
24	.62	.68	.69	.99	.99	1.97	.92
25	.65	.66	.91	1.01	1.02	1.95	.86
26	.65	.68	.94	.99	1.02	1.85	.81
27	.68	.68	.92	.96	1.02	1.79	.79
28	.68	.68	.89	.95	1.02	1.79	.76
29	.70	.....	.89	.93	1.25	1.72	.75
30	.69	.....	.88	.91	1.52	1.64	.76
31	.70	.....	.89	.....	1.55	.....	.79

NOTE.—Ice conditions January 1 to March 15.

Rating table for Highwood Creek near Highwood, Mont., for 1905 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.10	0	0.70	6	1.30	31	1.90	164
.20	1	.80	7	1.40	41	2.00	216
.30	2	.90	9	1.50	54	2.10	276
.40	3	1.00	12	1.60	71	2.20	346
.50	4	1.10	17	1.70	94	2.30	416
.60	5	1.20	23	1.80	124		

NOTE.—The above table is applicable only for open-channel conditions. It is based on seven discharge measurements made during 1905 and 1906, and is fairly well defined between gage heights 0.7 foot and 1.3 feet. Outside these limits the rating is only approximate.

Monthly discharge of Highwood Creek near Highwood, Mont., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
March (19–31)	7	6	6.5	168
April	8	6	6.9	411
May	14	6	9.4	578
June	416	10	57.7	3,430
July	20	6	8.9	547
August	6	0	1.5	92
September	0	0	0	0
October	4	0	.3	18
November	5	4	5.0	298
December	6	5	5.3	326
The period				5,870
1906.				
March (16–31)	10	6	7.4	235
April	13	8	9.8	583
May	62	6	12.3	756
June (1–5; 11–30)		44	132	6,540
July	68	7	22.0	1,350
The period				9,460

NOTE.—Values are rated as follows: March to May, July, November, and December, 1905, and March to May, and July, 1906, good; June, 1905, fair; August and October, 1905, and June, 1906, approximate. June 6–10, 1906, the stage was too high to estimate.

MARIAS RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Marias River rises on the eastern slope of the main divide of the Rocky Mountains and flows in a general southeasterly direction to its junction with the Missouri. Throughout its entire length the river flows in a canyon and has a fall not exceeding 5 feet per mile. Its principal tributaries are Cutbank Creek, Willow Creek, and Cottonwood Creek, which enter from the north, and Two Medicine Creek, Birch Creek, and Teton River from the south. The most important of these is the Teton, which has its source in the Rocky Mountains, flows eastward in a course approximately parallel to that of Sun River, crossing and recrossing the sixth standard parallel north, and emptying into Marias River about 1 mile above the point where the latter joins the Missouri.

MARIAS RIVER NEAR SHELBY, MONT.

This station was established April 4, 1902, and discontinued June 30, 1906. It is located at the highway bridge near James A. Johnson's ranch, 7 miles south of Shelby, Mont. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 48, where are given also references to publications that contain data for previous years.

Discharge measurements of Marias River near Shelby, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 4	Freeman and Edson	280	280	2.36	470
May 2	W. B. Freeman	149	321	2.75	756
July 14	W. S. Hartman	155	318	2.70	758
August 27	do	163	393	3.31	1,420
September 25	do	135	202	2.09	289
October 27	Follansbee and Richards	160	356	3.05	1,070

Daily gage height, in feet, of Marias River near Shelby, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.05	3.1	2.6	2.1	2.9	4.25	17	2.05	2.9	2.2	2.6	3.2	4.2
2	2.05	3.1	2.6	2.1	2.9	4.3	18	2.07	2.9	2.15	2.6	3.2	4.1
3	2.05	3.15	2.6	2.2	2.9	4.4	19	2.1	2.9	2.15	2.6	3.25	4.1
4	2.05	3.15	2.6	2.3	2.8	4.5	20	2.1	2.85	2.2	2.7	3.3	4.05
5	2.05	3.15	2.5	2.3	2.85	4.5	21	2.15	2.8	2.2	2.8	3.4	4.0
6	2.0	3.1	2.5	2.3	2.85	4.6	22	2.2	2.8	2.2	2.8	3.6	3.9
7	2.0	3.1	2.5	2.3	2.9	4.75	23	2.5	2.8	2.25	2.8	3.8	3.8
8	2.0	3.1	2.45	2.3	2.9	4.8	24	2.5	2.75	2.25	2.8	3.8	3.7
9	2.0	3.05	2.45	2.35	2.9	4.9	25	2.55	2.75	2.3	2.9	3.9	3.6
10	2.0	3.05	2.4	2.4	2.9	4.8	26	2.6	2.7	2.4	2.9	3.9	3.6
11	2.0	3.05	2.4	2.5	2.95	4.8	27	3.0	2.65	2.5	2.8	3.9	3.5
12	2.0	3.05	2.35	2.5	2.95	4.7	28	3.0	2.6	2.6	2.85	4.0	3.5
13	2.05	3.0	2.3	2.5	3.05	4.65	29	3.05	.....	2.8	2.85	4.1	3.5
14	2.05	3.0	2.25	2.6	3.1	4.5	30	3.07	.....	2.9	2.9	4.15	3.6
15	2.05	2.95	2.2	2.6	3.1	4.5	31	3.07	.....	3.0	.....	4.2	.....
16	2.05	2.95	2.2	2.6	3.15	4.4							

NOTE.—Ice conditions January 23 to March 26.

Rating table for Marias River near Shelby, Mont., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	250	2.80	820	3.60	1,780	4.40	3,100
2.10	305	2.90	920	3.70	1,930	4.50	3,290
2.20	365	3.00	1,020	3.80	2,080	4.60	3,480
2.30	430	3.10	1,130	3.90	2,240	4.70	3,680
2.40	500	3.20	1,250	4.00	2,400	4.80	3,880
2.50	5.0	3.30	1,370	4.10	2,570	4.90	4,090
2.60	650	3.40	1,500	4.20	2,740	5.00	4,300
2.70	730	3.50	1,640	4.30	2,920		

NOTE.—The above table is applicable only for open-channel conditions. It is based on six discharge measurements made during 1906 and is well defined between gage heights 2.0 feet and 5.0 feet.

Monthly discharge of Marias River near Shelby, Mont., for 1906.

[Drainage area, 2,610 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January (1-22)	365	250	278	12,100	0.106	0.09
March (27-31)	1,020	570	796	7,890	.305	.06
April	920	305	634	37,700	.243	.27
May	2,740	820	1,460	89,800	.559	.64
June	4,090	1,640	2,820	168,000	1.08	1.20
The period				315,000		

NOTE.—No estimate for ice period, January 23 to March 26. Values for 1906 are probably good, although many of the gage heights are only approximate.

CUTBANK CREEK AT CUTBANK, MONT.

The gaging station was established August 4, 1905. It is located in the gorge just below the steel-trestle bridge of the Great Northern Railway, three-fourths mile west of Cutbank. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 50.

Discharge measurements of Cutbank Creek at Cutbank, Mont., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 31	W. B. Freeman	31	18	2.81	22
September 27	H. M. Morse	26	12	2.77	12
October 19	Freeman and Morse	48	44	3.30	58
November 19	W. B. Freeman	42	22	3.11	47
1906.					
April 3	Edson and Freeman	50	35	3.28	[a] 86
May 3	W. B. Freeman	50	35	3.21	86
May 24	do	51	66	3.44	212
June 10	Freeman and Hartman	95	95	3.66	382
July 13	W. S. Hartman	62	54	3.37	161
August 28	do		67	3.44	194
September 20	do	45	26	3.07	57
October 26	Follansbee and Richards	45	31	3.09	63

[a] Ice running.

NOTE.—These measurements were made at different sections.

Daily gage height, in feet, of Cutbank Creek at Cutbank, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.5	3.9	3.6	3.45	3.25	4.0	[illegible].5	3.0	3.3	3.0	3.3	3.2
2	3.4	4.0	3.7	3.3	3.2	3.5	3.5	3.0	3.3	3.0	3.3	3.2
3	3.55	4.0	3.5	3.55	3.2	3.8	3.5	3.0	3.25	3.0	3.3	3.55
4	3.4	4.0	3.7	3.45	3.3	3.8	3.5	3.0	3.2	3.0	3.3	3.55
5	3.4	4.1	3.7	3.35	3.35	3.95	3.4	3.0	3.2	3.0	3.2	3.55
6	3.45	4.1	3.55	3.35	3.3	4.05	3.4	3.0	3.2	3.0	3.2	3.45
7	3.4	3.9	3.75	3.4	3.3	3.9	3.4	3.0	3.2	3.0	3.2	3.25
8	3.6	3.95	3.65	3.35	3.3	3.8	3.45	3.0	3.1	3.0	3.2	3.4
9	3.7	4.15	3.55	3.3	3.2	3.7	3.4	3.0	3.1	3.0	3.1	.....
10	3.45	4.1	3.45	3.2	3.3	3.7	3.4	3.0	3.1	3.1	3.2	.....
11	3.15	4.1	3.4	3.1	3.3	3.7	3.4	3.0	3.1	3.1	3.3	.....
12	3.45	3.95	3.1	3.1	3.4	3.8	3.4	3.0	3.1	3.1	3.2	.....
13	3.3	3.9	3.5	3.05	3.5	3.9	3.35	3.0	3.1	3.1	3.3	3.8
14	3.3	4.0	3.9	3.0	3.5	3.95	3.4	3.0	3.1	3.1	3.4	.....
15	3.5	3.85	3.65	3.0	3.5	3.85	3.35	3.0	3.1	3.1	3.5	.....
16	3.5	3.75	3.5	3.0	3.6	3.7	3.3	3.0	3.1	3.1	3.6	.....
17	3.7	3.8	3.5	3.0	3.5	3.7	3.3	3.0	3.1	3.1	3.8	.....
18	3.45	3.85	3.55	3.0	3.4	3.65	3.3	3.0	3.1	3.1	3.1	.....
19	3.15	4.0	3.45	3.0	3.4	3.6	3.3	3.0	3.1	3.1	3.25	.....
20	3.15	3.9	3.6	3.1	3.4	3.6	3.25	3.0	3.1	3.1	3.75	4.0
21	3.25	3.9	3.5	3.1	3.4	3.5	3.2	3.0	3.1	3.1	3.8	.....
22	3.4	3.8	3.6	3.1	3.4	3.5	3.2	3.05	3.0	3.1	3.8	.....
23	3.35	3.85	3.2	3.2	3.4	3.6	3.2	3.2	3.0	3.1	3.75	.....
24	3.85	3.8	3.45	3.35	3.5	3.55	3.2	3.3	3.0	3.1	3.6	.....
25	3.85	3.6	3.65	3.4	3.55	3.5	3.2	3.45	3.0	3.1	3.5	.....
26	3.8	3.6	3.85	3.4	3.65	3.5	3.2	3.6	3.0	3.1	3.6	.....
27	3.8	3.65	3.8	3.35	3.8	3.5	3.15	3.5	3.0	3.3	3.5	3.8
28	3.8	3.5	3.85	3.3	3.75	3.6	3.1	3.4	3.0	3.5	3.5	.....
29	3.8	.....	3.65	3.3	4.0	3.6	3.1	3.4	3.0	3.4	3.4	.....
30	3.85	.....	3.55	3.3	4.3	3.55	3.1	3.3	3.0	3.4	3.3	.....
31	3.9	.....	3.5	.....	4.25	.....	3.1	3.3	.....	3.3	.....	.....

NOTE.—Ice conditions January 1–March 31; gage heights were to water surface in hole in ice. River frozen entirely across December 9–31; gage heights were to water surface. The following comparative readings were made:

Comparative ice and water readings, in feet, at Cutbank, Mont.

Date.	Water surface.	Top of ice.	Thickness of ice.
December 13	3.8	4.1	0.6
December 20	4.0	4.2	.7
December 27	3.8	4.2	.6

Above and below the gage the thickness of ice was 1.0–1.4 feet.

Rating table for Cutbank Creek at Cutbank, Mont.

JANUARY 1–DECEMBER 31, 1905.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.50	5	2.80	17	3.10	46	3.40	103
2.60	7	2.90	24	3.20	63	3.50	127
2.70	11	3.00	33	3.30	82	3.60	155

JANUARY 1 1906, TO DECEMBER 31, 1906.[b]

3.00	45	3.40	180	3.80	520	4.20	1,020
3.10	62	3.50	250	3.90	630	4.30	1,170
3.20	87	3.60	330	4.00	750		
3.30	125	3.70	420	4.10	880		

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905 and is not well defined.

[b] This table is applicable only for open-channel conditions. It is based on 7 discharge measurements made during 1906 and is well defined between gage heights 3.0 feet and 3.7 feet.

Monthly discharge of Cutbank Creek at Cutbank, Mont., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
August (4–31)	82	17	45.2	2,510
September	20	11	14.5	863
October	155	17	74.0	4,550
November	73	5	45.9	2,730
The period				10,700
1906.				
April	290	45	115	6,840
May	1,170	87	283	17,400
June	815	250	436	25,900
July	250	62	142	8,730
August	330	45	84.4	5,190
September	125	45	65.9	3,920
October	250	45	74.8	4,600
November	520	62	216	12,900
December			[a] 200	12,300
The period				97,800

[a] Estimated.

NOTE.—Values are rated as follows: August and September, 1905, and December, 1906, approximate; October, 1905, fair; November, 1905, and April, 1906, good; May to November, 1906, excellent.

TETON RIVER NEAR BELLEVIEW, MONT.

This station was established November 26, 1904, and was discontinued December 31, 1906. It is located in sec. 35, T. 25 N., R. 35 W., Montana prime meridian, about 16 miles above Chouteau, Mont. The nearest post-office is Belleview, Mont. The conditions at this station are described in Water-Supply Paper No. 172, page 52, where are given also references to publications that contain data for previous years.

May 8, 1906, the gage was moved 1½ miles up stream to Mr. Bjornstad's new ranch. There is no connection between the old and new gages. The bench mark of the present gage is a spike below a blaze in a 14-inch cottonwood tree 100 feet back of gage; elevation, 9.70 feet above gage datum.

Discharge measurements of Teton River near Belleview, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 12	G. Edson	38	27	0.02	25.2
May 9	do	35	32	[a] 2.90	43.1
June 22	Edson and Richards	45	58	[a] 3.51	17.0

[a] New gage at different section.

Daily gage height, in feet, of Teton River near Belleview, Mont., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Sept.	Oct.	Nov.	Dec.
1			0.8	3.4	3.5		3.1		3.15
2			.8	3.5	3.45		3.1	3.1	3.15
3			.8	3.65	3.5		3.1	3.1	3.25
4			.8	4.0	3.4		3.1	3.1	3.25
5			.8	4.1			3.1	3.05	3.2
6			.8	4.05	3.35		3.1	3.05	3.25
7			.8	3.9	3.3		3.1	3.1	3.25
8			.85	3.9	3.35			3.1	3.1
9			2.9	3.95	3.3	3.2	3.1	3.1	3.1
10			2.9	3.95	3.3		3.05	3.1	3.1
11	0.15		3.0		3.2		3.05	3.1	3.1
12	.25		3.1	4.0	3.3	3.2	3.05		3.1
13	.1		3.1	4.0	3.3	3.15	3.05	3.15	3.1
14	.15		3.1	3.85		3.15	3.05	3.15	3.1
15	.35		3.2		3.2	3.15		3.25	
16	.1		3.2	3.9	3.2	3.15	3.05	3.4	3.1
17			3.1	3.6	3.25	3.1	3.05	3.3	3.1
18				3.5	3.2	3.1	3.05	3.3	3.05
19		2.5	3.1	3.45	3.25		3.05	3.25	3.0
20		2.5	3.1	3.4	3.25	3.1	3.05	3.3	3.0
21				3.45	3.25	3.1	3.05	3.25	3.0
22			3.1	3.5	3.2	3.1	3.0	3.2	
23			3.1	3.5	3.15	3.1	3.05	3.2	
24			3.2	3.5	3.1	3.1	3.05	3.2	3.1
25		.7	3.25	3.45	3.1	3.1	3.05	3.2	3.1
26		.7	3.4	3.6	3.1	3.1	3.1	3.15	3.1
27		.7	3.3	3.65	3.1	3.1	3.1	3.1	3.1
28		.8	3.3	3.6	3.1	3.1	3.1	3.1	3.1
29		.8	3.45	3.6	3.1	3.1	3.1	3.2	3.1
30		.8	3.4	3.55	3.1	3.1	3.15	3.15	3.0
31			3.35		3.1		3.15		

NOTE.—Beginning May 9, the gage heights refer to the new gage, 1½ miles farther up the river.

TETON RIVER NEAR CHOUTEAU, MONT.

This station was established November 30, 1904, and was discontinued July 31, 1906. It is located at the highway bridge on the road from Chouteau to Augusta, Mont., and is about 1½ miles from the town of Chouteau. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 53, where are given also references to publications that contain data for previous years.

Discharge measurements of Teton River near Chouteau, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 13	Morse and Edson	13	5.2	1.75	7.2
May 9	G. Edson	12	4.7	1.70	4.6
June 23	Edson and Richards	12	6.1	1.71	7.8

Daily gage height, in feet, of Teton River near Chouteau, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1			1.86		1.70		
2							1.70
3				1.69			
4			1.85				
5							
6					1.70		
7			1.85	1.7			
8							
9					1.70	1.80	1.60
10							
11			1.85	1.67			
12					1.71		
13				1.75			
14			1.84			1.97	
15							
16				1.65	1.65		1.62
17	1.85	1.90	2.40				
18	1.85	1.90				1.92	
19							
20	1.90			1.60			1.50
21					1.70	1.90	
22	1.85	1.88					
23			1.85			1.71	
24				1.55	1.55		
25		1.85					
26							
27						1.77	
28				1.60	1.60		
29			1.87				
30							
31							

NOTE.—Ice conditions January 15 to March 29.

Monthly discharge of Teton River near Chouteau, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	7	1	3.9	232
May	6	1	4.1	252
June (9-30)	30	7	15.7	684
July (1-20)	6	1	2.8	111
The period				1,220

NOTE.—No estimate for ice period. The above results are approximate only, owing to lack of data. Discharge obtained directly from rating curve; missing days interpolated.

MILK RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Milk River rises in the undulating foothills of the Rocky Mountains in northwestern Montana, near the boundary line between the United States and Canada. Its headwaters flow northeastward into Canada and for about 100 miles its course is eastward, parallel with the international boundary; it then turns to the southeast, passes across the northern part of Montana, and empties into the Missouri.

SOUTH FORK OF MILK RIVER NEAR BROWNING, MONT.

This station was established April 28, 1905. It is located at Croff's ranch, 35 miles northeast of Browning, Mont. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 55.

Discharge measurements of South Fork of Milk River near Browning, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 13	W. B. Freeman	42	40	3.32	13.5
September 16	Richards and Hartman	29	19	3.27	11.2
October 24	Follansbee and Richards	33	27	3.48	24.7

NOTE.—These measurements were made at different sections.

Daily gage height, in feet, of South Fork of Milk River near Browning, Mont., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.60	3.50	5.42	3.55	3.00	3.25	3.15	3.35
2	.....	3.25	3.50	4.87	3.52	3.00	3.25	3.15	3.32
3	.....	3.30	3.50	4.47	3.50	3.00	3.25	3.15	3.38
4	.....	3.25	3.55	4.27	3.45	3.10	3.25	3.15	3.30
5	.....	3.55	3.55	4.17	3.40	3.15	3.20	3.25	3.35
6	.....	4.15	3.55	4.10	3.40	3.15	3.18	3.25	3.18
7	.....	4.10	3.50	4.02	3.40	3.15	3.15	3.25	3.30
8	.....	4.00	3.50	3.95	3.40	3.15	3.15	3.25	3.40
9	.....	3.87	3.45	3.90	3.32	3.10	3.15	3.25	3.42
10	.....	3.65	3.40	3.85	3.25	3.10	3.10	3.25	3.50
11	.....	3.62	3.35	3.77	3.20	3.05	3.10	3.25	3.48
12	.....	3.60	3.35	3.75	3.20	3.02	3.15	3.25	3.55
13	.....	3.57	3.32	3.75	3.22	3.00	3.20	3.25	3.50
14	.....	3.55	3.30	3.75	3.40	3.00	3.22	3.25	3.62
15	.....	3.55	3.30	3.70	3.38	3.00	3.25	3.25	3.65
16	3.25	3.55	3.52	3.65	3.35	2.95	3.25	3.25	3.40
17	3.25	3.57	3.55	3.62	3.30	2.95	3.25	3.30	3.38
18	3.25	3.60	3.50	3.60	3.30	2.90	3.20	3.35	3.65
19	3.25	3.60	3.47	3.55	3.30	2.90	3.20	3.35	3.62
20	3.25	3.60	3.50	3.55	3.20	2.90	3.18	3.35	3.58
21	3.25	3.60	3.55	3.55	3.20	3.00	3.15	3.35	3.55
22	3.25	3.50	3.67	3.82	3.15	3.32	3.15	3.35	3.52
23	3.25	3.50	3.62	4.35	3.15	3.65	3.15	3.42	3.48
24	3.25	3.60	3.92	4.17	3.10	3.68	3.15	3.52	3.45
25	3.25	3.60	4.25	4.05	3.10	3.65	3.12	3.45	3.40
26	3.30	3.60	4.50	3.90	3.10	3.58	3.10	3.45	3.40
27	3.52	3.55	4.40	3.72	3.10	3.50	3.12	3.50	3.42
28	3.75	3.55	4.25	3.67	3.10	3.38	3.15	3.48	3.42
29	3.90	3.50	5.20	3.62	3.05	3.35	3.15	3.42	3.40
30	3.87	3.50	4.90	3.60	3.05	3.30	3.15	3.40	3.40
31	3.85	.....	5.50	.....	3.02	3.25	.....	3.38	.....

NOTE.—Ice conditions March 16–24, also April 3–5.

Rating table for South Fork of Milk River near Browning, Mont., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.90	1.5	3.60	37	4.30	146	5.00	301
3.00	2.5	3.70	48	4.40	166	5.10	325
3.10	5	3.80	61	4.50	187	5.20	350
3.20	8	3.90	76	4.60	209	5.30	375
3.30	13	4.00	92	4.70	231	5.40	401
3.40	19	4.10	109	4.80	254	5.50	427
3.50	27	4.20	127	4.90	277		

NOTE.—The above table is applicable only for open-channel conditions. It is based on three discharge measurements made during 1906 and on the form of the 1905 curve. It is not well defined.

Monthly discharge of South Fork of Milk River near Browning, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March (16–31)	76	10	25.7	816
April	118	10	40.2	2,390
May	427	13	76.1	4,680
June	406	32	90.7	5,400
July	32	3	12.6	775
August	46	1	10.7	658
September	10	5	7.3	434
October	29	6	14.3	879
November	42	7	23.6	1,400
The period				17,400

NOTE.—Values are rated as follows: March, approximate; April, August, and September, good; May and June, fair; July, October, and November, excellent.

MILK RIVER AT HAVRE, MONT.

This station was established May 15, 1898. It is located at the highway bridge at Havre, Mont. Gage heights are furnished by the United States Weather Bureau. The conditions at this station and the bench marks[a] are described in Water Supply Paper No. 172, page 57, where are given also references to publications that contain data for previous years.

Discharge measurements of Milk River at Havre, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 11	W. B. Freeman	80	79	4.07	115
April 20	Freeman and Morse	50	58	3.77	68
May 2	W. B. Freeman	47	42	3.39	42
May 27	do	85	87	4.18	134
May 30	do	158	202	5.00	414
May 30	do	158	300	5.62	951
May 31	do	160	406	6.43	1,130
June 9	Freeman and Hartman	165	889	8.40	2,630
June 9	do	165	964	8.80	3,120
June 14	Freeman and Morse	153	282	5.65	1,030
July 18	W. S. Hartman	48	64	3.39	65
August 26	do			2.60	5
October 28	Follansbee and Richards			2.33	2

[a] The bench mark is 25.26 feet above datum of gage.

Daily gage height, in feet, of Milk River at Havre, Mont., for 1906.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.7	4.2	3.4	5.7	4.6	2.7	2.5	2.3	2.2
2	.....	3.7	3.9	3.4	5.5	4.5	2.6	2.5	2.3	2.2
3	.....	3.7	3.8	3.15	5.4	4.5	2.6	2.5	2.3	2.2
4	.....	3.7	4.0	3.5	5.4	4.3	2.6	2.5	2.3	2.2
5	.....	3.6	4.3	3.4	5.5	4.0	2.6	2.4	2.3	2.2
6	.....	3.4	4.3	3.4	5.3	4.0	2.6	2.4	2.3	2.2
7	.....	3.2	4.0	3.4	5.6	3.9	2.6	2.4	2.3	2.2
8	.....	3.2	4.0	3.4	9.45	3.8	2.6	2.4	2.3	2.2
9	.....	3.1	4.0	3.3	8.7	3.7	2.6	2.4	2.3	2.2
10	.....	3.0	4.0	3.3	7.2	3.6	2.5	2.4	2.3	2.2
11	.....	.....	4.1	3.3	7.75	3.6	2.5	2.4	2.3	2.25
12	.....	.....	4.1	3.3	7.1	3.6	2.5	2.4	2.3	2.3
13	.....	.....	4.3	3.3	6 6	3.5	2.5	2.4	2.3	2.6
14	.....	.....	4.4	3.45	5.8	3.4	2.4	2.4	2.3	2.6
15	.....	.....	4.3	3.3	5.4	3.4	2.4	2.4	2.3	2.8
16	.....	.....	4.3	3.5	5.1	3.3	2.4	2.4	2.3	.....
17	2.4	.....	4.2	3.6	4.9	3.3	2.4	2.4	2.2	.....
18	2.4	.....	3.95	3.5	4.8	3.3	2.4	2.4	2.2	.....
19	2.4	.....	3.8	3.4	4.9	3.3	2.4	2.4	2.2	.....
20	2.4	.....	3.7	3.4	4.6	3.1	2.4	2.4	2.2	.....
21	2.4	.....	3.7	3.95	4.6	3.1	2.4	2.4	2.2	.....
22	2.4	.....	3.65	3.5	4.7	3.0	2.7	2.3	2.2	.....
23	2.4	.....	3.5	3.4	4.9	2.9	2.8	2.3	2.2	.....
24	2.4	.....	3.4	3.5	4.7	2.9	2.7	2.3	2.2	.....
25	2.5	3.0	3.4	4.0	4.6	2.9	2.6	2.3	2.2	.....
26	3.7	3.0	3.3	4.1	4.9	2.8	2.6	2.3	2.2	.....
27	3.7	4.0	3.4	4.2	4.7	2.8	2.5	2.3	2.2	.....
28	.....	4.0	3.3	4.4	4.8	2.8	2.5	2.3	2.2	.....
29	.....	4.1	3.3	4.6	4.95	2.7	2.5	2.3	2.2	.....
30	.....	4.2	3.4	5.65	4.8	2.7	2.5	2.3	2.2	.....
31	.....	4.4	.....	6.55	.....	2.7	2.5	.....	2.2	.....

NOTE.—Ice conditions January 1 to March 26; also November 12 to December 31.

Rating table for Milk River at Havre, Mont., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.10	21	4.40	183	5.70	712	7.00	1,540
3.20	26	4.50	210	5.80	766	7.20	1,690
3.30	32	4.60	239	5.90	822	7.40	1,840
3.40	38	4.70	271	6.00	880	7.60	2,000
3.50	46	4.80	305	6.10	940	7.80	2,165
3.60	55	4.90	342	6.20	1,000	8.00	2,340
3.70	65	5.00	381	6.30	1,065	8.20	2,520
3.80	77	5.10	422	6.40	1,130	8.40	2,700
3.90	90	5.20	466	6.50	1,195	8.60	2,880
4.00	104	5.30	512	6.60	1,260	8.80	3,060
4.10	120	5.40	560	6.70	1,330	9.00	3,240
4.20	138	5.50	610	6.80	1,400	9.20	3,440
4.30	159	5.60	660	6.90	1,470	9.40	3,640

NOTE.—The above table is applicable only for open channel conditions. It is based on discharge measurements made during 1906 and is well defined. After June 9 the above table was applied indirectly.

Monthly discharge of Milk River at Havre, Mont., for 1906.

[Drainage area, 7,300 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March (27-31)	183	104	130	1,290	0.018	0.003
April	183	32	94.6	5,630	.013	.01
May	1,230	24	119	7,320	.016	.02
June	3,690	420	935	55,600	.128	.14
July	390	9	101	6,210	.014	.02
August	14	3	5.2	320	.00071	.0008
September	4	2	2.8	167	.00038	.0004
October	2	1	1.5	92	.0002	.0002
November (1-15) [a]	1	1	1.0	30	.0001	.0001
The period				76,700		

[a] No flow after November 16.

NOTE.—Values are rated as follows: March and April, excellent; May, good; June, fair; July to September, approximate. No flow remainder of year.

MILK RIVER AT MALTA, MONT.

This station was established July 31, 1902. It is located at the highway bridge on the main road one-half mile east of the railroad station at Malta, Mont. The gage was read during 1906 by M. W. Walcott. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 59, where are given also references to publications that contain data for previous years.

Discharge measurements of Milk River at Malta, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 17	W. B. Freeman			0.80	10
June 2	Freeman and Hartman	152	661	6.49	3,190
June 3	do	152	722	6.82	3,260
June 5	do	125	392	4.53	1,780
June 11	W. S. Hartman	188	2,570	17.65	10,600
June 11	do	188	2,540	17.56	9,720
June 13	do	185	2,380	16.66	9,740
June 13	Morse and Hartman	175	2,060	16.21	9,000
June 14	do	175	2,100	14.82	8,100
June 14	W. S. Hartman	175	1,960	14.03	7,980
June 16	do	163	1,160	9.28	4,920
June 16	do	157	936	7.90	3,970
July 11	do	90	164	2.53	416
July 26	do		40	1.41	78
October 30	Follansbee and Richards	80	95	1.68	118

Daily gage height, in feet, of Milk River at Malta, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.2	0.2	0.2	0.2	0.6	4.7	5.0	1.2	1.0	1.1	1.4	.....
2	.2	.2	.2	.2	.7	6.2	4.4	1.2	1.1	.....	.....	.....
3	.2	.2	.2	.2	.7	6.95	3.9	1.2	1.1	1.1	1.4	1.4
4	.2	.2	.2	.2	.6	4.7	3.5	1.2	1.1	.....	1.4	.....
5	.2	.2	.2	.2	.6	4.0	3.3	1.2	1.1	.....	.....	1.4
6	.2	.2	.2	.2	.6	4.0	3.1	1.2	1.1	1.1	1.4	.....
7	.2	.2	.2	.2	.6	4.0	3.0	1.1	1.1	1.0	.....	.....
8	.2	.2	.2	.2	.6	17.5	2.9	1.1	1.1	.....	1.4	1.4
9	.2	.2	.2	1.0	.6	18.33	2.7	1.1	1.1	.....	.....	.....
10	.2	.2	.2	.6	.6	17.92	2.6	1.0	1.1	1.0	1.4	.....

Daily gage height, in feet, of Mill River at Malta, Mont., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	0.2	0.2	0.2	1.1	0.5	16.7	2.5	1.0	1.1	.....	.....	.....
12	.2	.2	.2	1.2	.5	17.5	2.4	1.0	1.1	.....	1.4	.....
13	.2	.2	.2	1.2	.6	17.33	2.0	1.0	1.1	1.0	.....	.....
14	.2	.2	.2	1.2	.6	15.0	2.2	1.0	1.2	1.1	1.5	.....
15	.2	.2	.2	1.2	.6	12.3	1.9	1.0	1.2	.....	.....	.....
16	.2	.2	.2	1.1	.6	8.66	1.8	1.0	2.5	.....	.....	.....
17	.2	.2	.2	1.0	.5	5.9	1.6	1.0	2.3	1.1	1.5	.....
18	.2	.2	.2	1.0	.5	5.0	1.6	.9	2.0	.....	.....	.....
19	.2	.2	.2	.9	.5	4.55	1.6	.9	1.5	.....	1.5	.....
20	.2	.2	.2	.8	.5	4.1	1.5	.9	1.4	1.2	.....	.....
21	.2	.2	.2	.8	.6	3.8	1.5	.9	1.3	.....	.....	.....
22	.2	.2	.2	.8	.5	3.65	1.5	1.0	1.2	1.2	1.4	.....
23	.2	.2	.2	.8	.5	3.65	1.4	1.0	1.2	.....	.....	.....
24	.2	.2	.2	.7	.8	3.85	1.3	1.0	1.2	.....	1.4	.....
25	.2	.2	.2	.7	1.5	4.15	1.2	1.0	1.2	1.0	.....	.....
26	.2	.2	.2	.7	3.0	4.6	1.2	1.0	1.2	.....	1.4	.....
27	.2	.2	.2	.6	3.0	4.4	1.2	1.0	1.2	1.0	.....	.....
28	.2	.2	.2	.6	2.6	8.9	1.2	1.0	1.1	.....	.....	.....
29	.2	.....	.2	.6	2.6	7.75	1.2	1.0	1.1	1.1	1.4	.....
30	.2	.....	.2	.7	3.8	6.1	1.2	1.0	1.1	1.7	1.4	.....
31	.2	.....	.2	.....	4.0	.....	1.2	1.0	.....	1.5	.....	.....

NOTE.—River frozen over January 1 to April 8, approximately, November 29 to December 31.

Rating table for Milk River at Malta, Mont., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.70	1	1.60	197	2.50	412	3.40	939
.80	6	1.70	129	2.60	463	3.50	1,003
.90	12	1.80	153	2.70	517	3.60	1,067
1.00	19	1.90	180	2.80	573	3.70	1,132
1.10	28	2.00	210	2.90	631	3.80	1,198
1.20	39	2.10	243	3.00	691	3.90	1,264
1.30	53	2.20	280	3.10	751	4.00	1,330
1.40	69	2.30	320	3.20	813	4.20	1,464
1.50	87	2.40	364	3.30	875	4.40	1,598

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904-6 and is well defined. Above gage height 4 feet the rating curve is a tangent, the difference being 67 per tenth.

Monthly discharge of Milk River at Malta, Mont., for 1906.

[Drainage area, 14,000 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	39	0	10.0	595	0.00071	0.001
May	1,330	0	159	9,780	.011	.01
June	10,900	1,100	4,150	247,000	.296	.33
July	2,000	39	399	24,500	.028	.03
August	39	12	22.8	1,400	.0016	.002
September	412	19	63.4	3,770	.0045	.005
October	129	19	31.6	1,940	.0023	.003
November	87	69	73.5	4,370	.0052	.006
The period	.....	.....	.....	293,000	.....	.....

NOTE.—No flow January 1 to April 8. Values are rated as follows: May to July, good; April and August to November, approximate, owing to frequent errors in gage readings.

WEST FORK OF MILK RIVER AT CHINOOK, MONT.

This station was established March 6, 1906. It is located at the highway bridge three-fourths mile east of Chinook.

The channel is comparatively straight for 75 yards above and 50 yards below the station. Both banks are high and overflow only at the highest stages, when the surrounding country is flooded. There is considerable brush on the banks. The bed is composed of mud and may shift somewhat. The current is sluggish.

Discharge measurements are made from the highway bridge to which the gage is attached. The initial point for soundings is at the west end of the bridge.

The gage, which is read twice each day by Miss Cassie M. Prosser, is of the standard chain type. It is attached to the upstream side of the bridge; length of chain, 20.33 feet. The bench mark is the head of a bolt holding the plate girder to the bedplate at the southeast corner of the railroad bridge 100 feet above the highway bridge; elevation, 18.55 feet above the gage datum.

Discharge measurements of West Fork of Milk River at Chinook, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 18	Morse and Freeman			3.02	[a] 13
April 25	do			2.90	[a] 1.0
May 28	W. B. Freeman	41	223	6.50	212
May 28	do	42	241	6.95	242
May 29	do	50	333	9.07	413
May 29	do	50	346	9.32	420
May 30	do	60	433	10.70	619
May 31	Freeman and Hartman	75	816	16.17	1,490
May 31	do	78	835	16.42	1,470
June 1	W. B. Freeman	90	866	16.58	1,800
June 2	Freeman and Hartman	68	583	12.66	1,010
June 2	do	62	518	11.79	948
June 5	do	38	171	5.30	148
June 12	Freeman and Morse	70	664	13.92	1,030
June 16	W. B. Freeman	37	191	5.57	179
June 25	Freeman and Hartman	68	605	13.26	901
July 23	W. S. Hartman	21	27	2.30	7.8
August 11	Morse and Hartman			2.73	.2

[a] Estimated.

Daily gage height, in feet, of West Fork of Milk River at Chinook, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		2.9	16.5	4.8	2.5	2.85	3.1	3.4	
2		2.9	13.5	4.45	2.5	2.95	3.1	3.4	
3		2.9	8.55	4.4	2.5	2.85	3.2	3.4	
4		2.9	6.45	4.25	2.55	2.85	3.15	3.3	
5		2.9	5.3	4.0	2.6	2.85	3.1	3.45	
6		2.9	7.97	3.8	2.6	2.85	3.1	3.4	
7		2.95	11.0	3.65	2.55	2.85	3.1	3.4	
8		2.95	16.3	3.65	2.65	2.85	3.1	3.45	
9	3.7	2.9	16.75	3.55	2.65	2.9	3.25	3.5	
10	3.55	2.9	16.9	3.45	2.65	2.9	3.3	3.5	
11	3.6	2.9	16.8	2.9	2.65	2.95	3.3	3.5	3.2
12	3.3	2.9	13.5	2.75	2.65	2.95	3.3	3.5	
13	3.2	2.95	10.65	2.85	2.65	2.85	3.3	3.5	
14	3.15	2.9	7.8	2.9	2.65	2.9	3.4	3.5	
15	2.95	2.9	6.3	2.65	2.75	3.1	3.5	3.5	3.2

Daily gage height, in feet, of West Fork of Milk River at Chinook, Mont., for 1906—Con.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	2.9	2.9	5.5	2.4	2.75	2.9	3.6	3.5	.....
17	2.9	2.9	5.0	2.4	2.85	2.9	3.5	3.5	.....
18	3.0	2.9	4.6	2.4	2.85	2.85	3.4	3.4	3.2
19	3.1	3.0	4.25	2.4	2.85	2.9	3.4	3.4	.....
20	3.1	2.9	4.0	2.4	2.85	3.1	3.5	3.4	.....
21	3.0	3.0	3.9	2.35	2.85	3.1	3.6	3.4	.....
22	3.0	3.0	3.75	2.3	2.95	3.1	3.6	3.4	3.2
23	3.0	3.0	12.26	2.3	2.95	3.05	3.5	3.4	.....
24	3.0	3.0	8.56	2.2	2.95	3.15	3.5	3.5	.....
25	2.9	3.0	12.86	2.2	2.85	3.1	3.5	3.5	.....
26	2.9	3.05	10.9	2.2	2.85	3.1	3.5	3.5	.....
27	2.9	3.0	8.15	2.2	2.85	3.2	3.4	3.5	.....
28	2.9	6.1	7.4	2.2	2.9	3.2	3.4	3.5	3.2
29	2.9	9.25	6.05	2.2	2.9	3.1	3.4	3.5	.....
30	2.9	11.35	5.2	2.3	2.85	3.1	3.4	3.5	.....
31	.....	16.35	.....	2.5	2.85	.....	3.4	.....	.....

NOTE.—No flow January 1 to April 8; practically none after August 8.

Daily discharge, in second-feet, of West Fork of Milk River at Chinook, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1	.....	2	1,830	103	3	17	2	2	142	8	.....
2	.....	2	1,160	82	3	18	9	2	116	8	.....
3	.....	2	430	80	2	19	14	9	90	8	.....
4	.....	2	220	72	2	20	14	2	74	8	.....
5	.....	2	148	58	2	21	9	9	68	7	.....
6	.....	2	312	48	1	22	9	9	60	6	.....
7	.....	5	630	42	1	23	9	9	792	6	.....
8	.....	5	1,550	42	1	24	9	9	364	6	.....
9	48	2	2,450	36	0	25	2	9	875	5	.....
10	40	2	3,000	34	.....	26	2	12	618	5	.....
11	43	2	2,650	10	.....	27	2	9	327	5	.....
12	26	2	968	13	.....	28	2	181	270	4	.....
13	20	5	586	15	.....	29	2	430	182	4	.....
14	17	2	300	17	.....	30	2	690	128	4	.....
15	5	2	298	10	.....	31	.....	1,580	.....	3	.....
16	2	2	175	8	.....						

NOTE.—Practically no flow January 1 to April 9 and after August 9.

Monthly discharge of West Fork of Milk River at Chinook, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April (9-30)	48	2	13.1	572
May	1,580	2	96.9	5,960
June	3,000	60	694	41,300
July	103	3	24.4	1,500
August (1-8)	3	1	1.9	30
The period	.....	.....	.....	49,400

NOTE.—From January 1 to April 8 and from August 9 to December 31 there was practically no flow. Values are rated as follows: April and August, approximate; May to July, fair.

NORTH FORK OF MILK RIVER NEAR CHINOOK, MONT.

This station was established April 22, 1905. It is located at Snedecor's ranch, about 4½ miles north of Chinook, Mont. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 61. A standard chain gage was erected July 20, 1906, on the site of the old inclined board gage. It reads the same as the old gage.

Discharge measurements of North Fork Milk River near Chinook, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 7	W. B. Freeman	55	74	1.89	116
April 18	Freeman and Morse	51	48	1.42	56
April 25	do	55	33	1.17	31.3
May 7 [a]	W. B. Freeman	28	27	1.00	19.5
May 19 [a]	do	28	24	.90	14.7
May 26	do	50	74	1.91	116
May 29	do	54	99	2.38	211
May 30	do	74	465	7.66	1,960
May 30	do	75	508	8.16	2,360
May 31	do	71	400	6.80	1,270
June 1	Freeman and Hartman	66	306	5.20	882
June 2	do	58	183	3.44	460
June 8	W. S. Hartman	86	687	9.66	2,400
June 13	W. B. Freeman	78	529	8.55	2,260
June 25	Freeman and Hartman	58	86	1.89	176
July 18	W. S. Hartman	[a] 38	[a] 35	1.16	41.1
August 11	Morse and Hartman	[a] 36	[a] 14	.49	11.6
September 21	W. S. Hartman	[a] 33	[a] 20	.55	22.8
October 29	Follansbee and Richards	[a] 34	[a] 32	.80	35.8

[a] Wading section.

Daily gage height, in feet, North Fork of Milk River near Chinook, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.90	1.00	1.00	1.57	1.07	5.15	1.86	0.60	0.70	0.65	0.80	1.10
2	.90	1.10	1.00	1.47	1.07	3.60	1.76	.60	.70	.65	.80	1.10
3	.90	1.10	1.00	1.42	1.07	3.07	1.70	.60	.69	.65	.80	1.20
4	.90	1.10	1.00	1.37	1.07	2.60	1.62	.60	.66	.65	.80	1.20
5	.90	1.10	.90	1.42	1.07	2.22	1.52	.60	.64	.65	.80	.....
6	.90	1.10	.80	1.62	1.07	2.02	1.39	.60	.62	.65	.80	.....
7	.90	1.10	.80	1.92	1.02	8.15	1.38	.60	.60	.64	.80	.....
8	.90	1.10	.80	1.72	1.02	12.60	1.34	.60	.50	.62	.85	.....
9	.90	1.10	.80	1.67	.97	5.65	1.30	.60	.50	.55	.85	.....
10	.90	1.10	.80	1.77	.97	6.45	1.25	.58	.50	.48	.90	.....
11	.90	1.10	.80	1.82	.92	6.22	1.20	.51	.50	.40	.90	.....
12	.90	1.10	.80	1.84	.87	6.65	1.16	.49	.50	.68	.90	.....
13	.90	1.10	.80	1.74	.82	8.32	1.10	.48	.50	.70	.90	.....
14	.90	1.10	.80	1.62	.82	4.29	1.05	.46	.58	.70	.90	.....
15	.90	1.10	.80	1.52	.82	3.16	1.03	.45	.80	.70	.92	.....
16	.90	1.10	.80	1.47	.82	4.75	.98	.45	.60	.70	.95	.....
17	.90	1.10	.80	1.47	.82	2.34	.88	.45	.60	.70	.95	.....
18	.90	1.10	.80	1.47	.77	2.11	.85	.45	.59	.75	.95	.....
19	.90	1.00	.80	1.37	.92	1.96	.84	.45	.56	.75	.95	.....
20	.90	1.00	.80	1.37	.90	2.04	.81	.45	.54	.80	.95	.....
21	.90	1.00	.80	1.32	1.35	1.76	.76	.45	.50	.80	.95	.....
22	.90	1.00	.80	1.30	1.25	1.66	.74	.45	.50	.80	.95	.....
23	.90	1.00	.80	1.27	1.20	2.01	.72	.50	.50	.80	.95	.....
24	.90	1.00	.80	1.22	1.50	2.01	.69	.55	.55	.80	.95	.....
25	.90	1.00	.80	1.17	1.90	2.04	.68	.55	.55	.80	.95	.....
26	.90	1.00	.90	1.17	1.90	2.44	.66	.60	.60	.80	.95	.....
27	.90	1.00	.90	1.12	1.75	2.29	.65	.60	.60	.80	.95	.....
28	.90	1.00	.90	1.12	2.05	2.19	.65	.62	.60	.80	.95	.....
29	.90	.....	1.10	1.12	2.82	2.49	.64	.70	.60	.80	.95	.....
30	.90	.....	1.30	1.12	7.47	2.16	.63	.70	.60	.80	.95	.....
31	.90	.....	1.40	.....	7.40	.....	.62	.70	.....	.80	.....	.....

NOTE.—Ice conditions January 1 to March 16. From November 18 to December 31 the river was frozen to the bottom at the gage, but at the farther side there was considerable flow; thickness of ice, 0.5 foot to 1 foot.

Rating tables for North Fork Milk River near Chinook, Mont.

MARCH 27, 1906, TO JUNE 13, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	11	2.10	154	3.40	443	5.40	961
.90	15	2.20	175	3.50	467	5.60	1,020
1.00	20	2.30	196	3.60	491	5.80	1,084
1.10	26	2.40	217	3.70	515	6.00	1,153
1.20	34	2.50	239	3.80	539	6.20	1.226
1.30	43	2.60	261	3.90	563	6.40	1,303
1.40	53	2.70	283	4.00	588	6.60	1,384
1.50	64	2.80	305	4.20	638	6.80	1,467
1.60	76	2.90	328	4.40	689	7.00	1,551
1.70	89	3.00	351	4.60	741	8.00	1,985
1.80	103	3.10	374	4.80	794		
1.90	118	3.20	397	5.00	848		
2.00	135	3.30	420	5.20	904		

JUNE 14, 1906, TO NOVEMBER 14, 1906.[b]

0.40	10	1.50	112	2.60	330	3.70	576
.50	15	1.60	127	2.70	352	3.80	599
.60	21	1.70	144	2.80	374	3.90	622
.70	27	1.80	163	2.90	396	4.00	645
.80	35	1.90	183	3.00	418	4.20	693
.90	43	2.00	204	3.10	440	4.40	741
1.00	52	2.10	225	3.20	462	4.60	790
1.10	62	2.20	246	3.30	484	4.80	840
1.20	73	2,30	267	3.40	507		
1 30	85	2.40	288	3.50	530		
1.40	98	2.50	309	3.60	553		

[a] This table is applicable only for open-channel conditions. It is based on thirteen discharge measurements made during the first part of 1906, and is well defined between gage heights 0.9 foot and 5 feet. Above 5 feet gage height the table is rather uncertain, as the high-water measurements are not very consistent.

[b] This table is applicable only for open-channel conditions It is based on four discharge measurements made during the latter part of 1906 and the form of the curve before high water. It is not very well defined.

Monthly discharge of North Fork of Milk River near Chinook, Mont., for 1906.

[Drainage area, 1,420 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March (28-31)	53	15	34.2	271	0.024	0.003
April	121	28	61.6	3,670	.043	.05
May	1,750	10	155	9,530	.109	.13
June	4,600	137	709	42,200	.499	.56
July	175	22	63.5	3,900	.045	.05
August	27	12	18.0	1,110	.013	.01
September	35	15	20.0	1,190	.014	.02
October	35	10	28.2	1,730	.020	.02
November	43	35	39.3	2,340	.028	.03
The period				65,900		

NOTE.—Values are rated as follows: March and July, good; April to June, excellent; August to November, fair.

BEAVER CREEK NEAR ASHFIELD, MONT.

This station was established July 5, 1903, at bridge No. 455 of the Great Northern Railway, one-half mile west of Ashfield, Mont. It was abandoned December 31, 1903, because the results were affected by backwater from a dam erected a mile below about a month after

the establishment of the station. A new station was established at a point 2½ miles farther upstream and beyond the influence of the dam. It is near the ranch house of R. H. Thomas, about 18 miles from Malta and 3 miles south of Ashfield, Mont., the nearest post-office. This station was discontinued August 30, 1906. The conditions at the station and the bench marks are described in Water-Supply Paper No. 172, page 63, where are given also references to publications that contain data for previous years.

Discharge measurements of Beaver Creek near Ashfield, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 4	Freeman and Hartman	70	422	8.59	594
July 14	W. B. Freeman	[a] 17	[a] 13	0.05	19.2

[a] Wading section.

Daily gage heights and discharge of Beaver Creek near Ashfield, Mont., for 1906.

Day.	May.		June.		July.		Day.	May.		June.		July.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1			9.0	695	11.9	3,700	17			6.2	270	−0.1	10
2			10.3	1,230	10.8	1,670	18			5.4	220	.2	8
3			10.4	1,290	7.3	365	19			4.4	164	.2	8
4			8.85	660	5.0	195	20			3.75	132	.2	8
5			7.3	365	3.9	139	21			2.9	95	.4	4
6			5.1	202	3.0	98	22			2.3	70	.4	4
7			7.9	450	2.5	78	23			2.5	78	.5	2
8			[a]	5,000	1.7	50	24			2.5	78	.5	2
9			[a]	6,650	1.1	34	25	1.0	30	2.1	63	.6	1
10			[a]	6,100	.8	25	26	6.4	280	1.6	47	.6	1
11			[a]	5,500	1.2	36	27	9.2	785	1.5	44	.6	1
12			12.3	5,000	.9	28	28	10.6	1,380	1.9	55	.7	0
13			11.9	3,700	.5	20	29	10.8	1,500	5.1	202		
14			11.05	2,120	.1	16	30	9.8	1,010	12.0	4,000		
15			8.6	590	.0	12	31	9.6	935				
16			6.8	315	−.1	10							

[a] Gage not read on account of high water. Discharge estimated from high-water marks.

NOTE.—Practically no flow January 1 to May 25 and July 29 to December 31.

Monthly discharge of Beaver Creek near Ashfield, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean	
May 25–31	1,500	30	846	11,700
June	6,650	44	1,510	89,800
July 1–27	3,700	1	242	13,000
The period				114,500

NOTE.—Values are approximate.

BEAVER CREEK OVERFLOW NEAR BOWDOIN, MONT.

This station was established June 29, 1903, and was discontinued August 30, 1906. It is located on an overflow channel of Beaver

Creek, about 4 miles southeast of the Great Northern Railway section house at Bowdoin, Mont., and is best reached by team from Malta, Mont., 14 miles distant. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 65, where are given also references to publications that contain data for previous years.

The following discharge measurement was made June 4, 1906:

Width, 108 feet; area of section, 376 square feet; gage height, 8.08 feet; discharge 476 second-feet.

Daily gage heights and discharge of Beaver Creek overflow near Bowdoin, Mont., for 1906.

Day.	May.		June.		July.		Day.	May.		June.		July.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1			8.55	710	9.2	1,160	17			6.5	128		
2			8.7	800	8.1	480	18			6.1	90		
3			8.65	765	6.6	140	19			5.4	43		
4			8.2	520	5.9	76	20			5.1	27		
5			7.2	224	5.3	37	21			4.9	20		
6			6.3	108	4.8	16	22			4.6	10		
7			7.9	400	4.3	5	23			4.7	13		
8			10.0	(a)	4.1	4	24			4.8	15		
9			10.8	(a)	3.9	3	25	6.65	145	4.5	8		
10			10.0	(a)	3.8	2	26	7.95	420	4.4	8		
11			9.4	1,320	3.7	1	27	8.65	765	4.3	5		
12			9.05	1,000	3.7	1	28	8.8	860	6.2	100		
13			8.8	860			29	8.7	800	8.85	900		
14			8.0	440			30	8.25	545	10.1	(a)		
15			7.6	310			31	8.25	545				
16			6.7	150									

a Discharge probably in excess of 2,000 second-feet.

NOTE.—Practically no flow January 1 to May 25 and July 13 to December 31.

Monthly discharge of Beaver Creek overflow near Bowdoin, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May 25-31	860	145	583	8,090
June 1-7, 11-29	1,320	5	345	17,800
July 1-12	1,160	1	160	3,810
The period				29,700

NOTE.—On June 8-10 and June 30 the flow was probably in excess of 2,000 second-feet (not included above). Values are wholly dependent on the constancy of the conditions of flow, being either good or approximate accordingly.

ROCK CREEK NEAR HINSDALE, MONT.

This station was established March 28, 1906. It is located just below the diversion dam for Rock Creek canal, and 7 miles north of Hinsdale.

The channel is straight for a considerable distance above and below the station. The banks are high and overflow only at very high stages. They are covered with scattering brush. During the latter part of the year flow ceases and the water is ponded at the station.

Discharge measurements are made by means of a cable and car located 200 yards below the gage. Low-water measurements must be made by wading.

The gage, which is read daily by F. E. Halbert, is of the standard type extending from posts set in the left bank; length of chain, 19.47 feet. The bench mark is a spike 8 inches above the ground, in the west side of a 10-inch cottonwood tree 70 feet east of the gage; elevation, 12.63 feet above the gage datum.

July 21, 1906, the discharge was estimated at 0.5 second-foot at a gage height of 1.38 feet.

Daily gage height, in feet, of Rock Creek near Hinsdale, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1	1.3	1.2	4.75	2.3	17	1.2	1.0	5.8	1.2
2	1.3	1.2	3.5	2.3	18	1.2	1.1	4.9	1.3
3	1.3	1.3	2.6	2.3	19	1.2	1.1	3.9	1.3
4	1.3	1.4	2.3	2.2	20	1.2	1.2	2.5	1.3
5	1.3	1.5	1.8	2.1	21	1.2	1.2	1.8	.....
6	1.4	1.5	1.4	1.9	22	1.2	1.2	1.5	.....
7	1.65	1.5	11.0	1.8	23	1.2	1.2	2.5	.....
8	1.4	1.5	18.4	1.8	24	1.2	1.2	2.5	.....
9	1.3	1.0	(a)	1.7	25	1.2	7.75	2.7	.....
10	1.3	1.0	7.2	1.4	26	1.2	10.2	2.4	.....
11	1.3	1.0	(a)	1.4	27	1.2	4.8	2.4	.....
12	1.3	1.0	(a)	1.1	28	1.2	3.4	2.4	.....
13	1.3	1.0	11.3	1.1	29	1.2	4.0	2.3	.....
14	1.2	1.0	9.3	1.0	30	1.2	9.5	2.3	.....
15	1.2	1.0	7.3	1.1	31	.....	6.3	.....	.....
16	1.2	1.0	6.4	1.2					

[a] No record on account of high water.

NOTE.—Practically no flow after July 20.

PRIVATE CANALS IN MILK RIVER VALLEY.

DESCRIPTION OF CANALS.

During 1906 a number of stations were maintained on private canals in Milk River Valley, mainly for the purpose of ascertaining the extent of the private water rights. With one exception—the Rock Creek canal near Hinsdale, in Valley County—these canals are located in Chouteau County and are used for the irrigation of lands in the vicinity of Harlem and Chinook.

The canals are all built on small grades and in soil which is easily eroded. In many of them deposition of silt has taken place, and in nearly all there is a growth of weeds and moss. At low stages the water is uniformly sluggish. In order to divert water into the laterals, checks are erected in the main channels, and these checks often produce backwater affects for long distances above. They were put up under a great variety of conditions, and as a result many different velocities are found to exist at the same gage height during the season; in order to establish the correct relation between gage height and discharge it has been found necessary in several instances to make several rating curves for the same canal station. During

June, 1906, occurred one of the greatest floods on Milk River that had been known. This injured several of the canal systems so severely that irrigation was not practiced to any great extent for the remainder of the season.

PARADISE VALLEY CANAL NEAR CHINOOK, MONT.

The station was established in June, 1903. It is reached by driving along the south river road from Chinook, Mont. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 67, where are given also references to publications that contain data for previous years.

Discharge measurements of Paradise Valley canal near Chinook, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 13	W. B. Freeman	15	6.0	0.94	3.05
May 5	do	9	3.4	.67	1.30
May 23	do	17	12.0	1.19	5.4
June 27	Freeman and Hartman	25	19.2	1.60	9.78
July 19	Hartman and Morse	30	25.3	1.79	14.3
July 25	W. S. Hartman	20	13.4	1.45	7.48
August 25	do				.0
September 5	do				.0

Daily gage height, in feet, of Paradise Valley canal near Chinook, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1		0.80	1.88	1.15	1.24	17	1.20	0.50		1.54	
2		.80	2.00	1.25	1.20	18	1.10	.50		1.71	
3		.80	2.00	1.25	1.15	19	.90	.55		1.78	
4		.70	2.00	1.21	1.10	20	.80	.55		1.76	
5		.65	2.00	1.18	1.00	21	.70	1.40		1.60	
6		.65	1.80	1.30	1.00	22	.70	1.50		1.53	
7		.65		1.20	.91	23	.80	1.10		1.52	
8	0.60	.65	1.40	1.10	.89	24	1.10	.95		1.56	
9	.65	.65		1.02	.83	25	.80	.90		1.48	
10	1.30	.65		1.80	.80	26	.80	1.23	1.65	1.43	
11	1.55	.60		1.61	.71	27	.80	1.55	1.60	1.38	
12	1.45	.60		1.58	.66	28	.70	1.95	1.50	1.29	
13	1.55	.60		1.50	.62	29	.80	1.85	1.55	1.21	
14	1.05	1.00		1.33	.50	30	.80	1.70	1.20	1.15	
15	1.30	.80		1.55	.40	31		1.80		1.17	
16	1.30	.50		1.62							

NOTE. No flow from June 9 to 25 nor after August 15.

Monthly discharge of Paradise Valley canal near Chinook, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April (8–30)	9.1	0.9	3.7	169
May	18.0	.4	4.0	246
June	19.4	.0	5.6	333
July	13.8	3.6	7.7	474
August (1–15)	5.4	.0	2.7	80
The season				1,300

NOTE.—Values are approximate owing to great and irregular fluctuation of daily stages.

COOK CANAL NEAR CHINOOK, MONT.

The station was established April 10, 1905. It is located at a small wooden highway bridge on the road running parallel to the Great Northern Railway about 3 miles east of Chinook. The gage was read during 1906 by Herbert Reynolds. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 70.

Discharge measurements of Cook canal near Chinook, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 6	W. B. Freeman	14	24.0	2.97	19.7
April 19	Freeman and Morse	14	24.1	2.73	18.9
April 23	do	14	17.9	2.21	6.00
May 5	W. B. Freeman				.00
May 23	do	14	26.9	2.80	16.6
May 28	do	14	34.6	3.58	35.1
June 5	Freeman and Hartman	14	39.8	3.79	43.9
June 26	do	14	25.9	2.85	19.4
July 19	Morse and Hartman	14	32.6	3.15	25.7
July 24	W. S. Hartman	14	33.0	3.23	24.3
August 11	do	12	25.8	2.86	8.38
August 25	do	14	30.5	2.91	9.18
September 3	do	14	20.7	2.25	3.40
September 21	do			2.12	[a] 2.5

[a] Estimated.

Daily gage height, in feet, of Cook canal near Chinook, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1		1.6	3.7	2.9	3.0	2.5	17	1.7	1.25	2.6	3.3	2.7	2.1
2		1.6	3.2	2.8	3.1	2.3	18	[b] 2.7	1.2	2.4	3.2	2.7	2.1
3		1.6	2.95	2.8	3.0	2.1	19	2.7	1.2	2.3	3.1	2.8	2.1
4		1.6	2.8	2.4	3.0	2.2	20	2.3	1.1	2.3	3.1	2.8	2.2
5		1.6	3.8	2.3	3.1	2.1	21	2.2	1.7	2.3	3.0	2.8	2.2
6	2.97	1.55	3.7	2.3	3.2	2.1	22	2.2	[b] 2.8	3.3	3.0	2.9	2.2
7		1.55	3.8	3.3	3.1	2.1	23	2.1	2.75	3.5	3.0	2.9	2.2
8		1.45	(a)	3.3	3.0	2.1	24	[a] 1.8	2.5	3.3	3.1	2.9	2.4
9	1.6	1.45	.....	3.3	3.0	2.1	25	1.7	2.8	3.0	3.3	2.9	2.5
10	1.6	1.4	.....	3.2	2.9	2.0	26	1.6	3.3	2.9	3.1	2.9	2.3
11	1.7	1.4	3.9	3.0	2.9	2.0	27	1.6	3.35	2.8	3.2	2.9	2.3
12	[b] 3.3	1.4	3.85	2.9	2.7	2.0	28	1.6	3.35	3.3	3.0	2.9	2.0
13	3.0	1.4	3.4	2.6	2.8	2.0	29	1.6	3.8	2.85	3.0	3.1	2.1
14	[a] 1.6	1.3	3.25	2.6	2.8	2.0	30	1.6	3.9	2.8	3.1	3.2	2.2
15	1.7	1.25	2.9	3.4	2.6	2.0	31	.....	4.1	.....	3.1	2.9	.....
16	1.7	1.25	2.6	3.3	2.7	2.1							

[a] Head-gate closed. [b] Head-gate open.

NOTE.—From June 8 to 21 the water in the canal was not used for irrigation, but was allowed to run into Milk River at the crossing.

Monthly discharge of Cook canal near Chinook, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 4–30 (27 days)	27.5	0.0	5.9	316
May	57.0	.0	9.5	584
June (16 days)	44.0	16.5	26.0	826
July	32.5	9.3	22.2	1,360
August	12.0	6.1	9.0	553
September	5.2	1.8	2.7	161
The season				3,000

NOTE.—Values are approximate owing to great and irregular fluctuation of daily stages.

MATHESON CANAL NEAR CHINOOK, MONT.

The station was established April 10, 1905. It is located at a footbridge 200 feet below the head-gates. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 72.

Discharge measurements of Matheson canal near Chinook, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 6	W. B. Freeman	9	8.8	2.36	7.10
April 7	do	10	13.8	2.81	15.3
April 9	do	9	8.7	2.30	7.62
April 23	Freeman and Morse	9	6.4	1.92	4.63
May 5	W. B. Freeman	9	4.5	1.75	2.37
May 23	do	9	12.5	2.65	10.3
May 28	do	10	14.6	2.83	11.8
June 5	Freeman and Hartman	9	12.6	2.61	8.80
June 26	do	7	2.5	2.12	2.49
July 19	H. M. Morse	9	5.6	2.51	7.04
July 24	W. S. Hartman	7	2.0	2.11	.37
August 11	Morse and Hartman	.....	.....	1.95	[a].25
August 25	W. S. Hartman	10	7.3	2.70	2.27
September 3	do	10	10.9	3.10	4.71
September 21	do	10	9.8	2.97	5.42

[a] Estimated.

Daily gage height, in feet, of Matheson canal near Chinook, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1.4	2.7	2.2	2.0	3.1	17	2.4	1.4	2.3	2.6	1.7	3.2
2	.....	1.8	3.2	2.0	1.9	3.0	18	2.2	1.3	2.3	2.7	1.9	3.1
3	.....	1.8	3.2	2.0	1.8	3.1	19	1.7	1.2	2.3	2.4	2.0	3.0
4	.....	1.8	2.8	1.9	1.5	3.1	20	2.2	1.7	2.25	2.3	2.9	3.0
5	.....	1.75	2.5	1.8	1.9	3.2	21	2.2	2.8	2.2	2.5	2.8	3.0
6	2.36	1.3	2.7	1.8	1.8	3.1	22	2.2	2.9	2.2	2.3	2.9	3.0
7	2.81	1.1	.....	1.7	1.8	3.1	23	1.9	2.65	2.2	2.1	3.0	2.9
8	2.3	1.3	.....	1.7	1.5	3.1	24	1.7	2.7	2.2	1.1	3.0	2.9
9	2.3	1.3	.....	1.8	2.0	3.1	25	1.7	2.9	2.2	1.0	3.1	3.0
10	2.3	1.3	.....	3.1	2.0	2.7	26	1.7	3.2	2.2	1.6	2.9	3.0
11	2.7	1.3	2.7	3.1	1.8	2.7	27	1.7	3.2	2.2	1.0	2.8	3.0
12	2.7	1.3	2.7	2.9	1.9	2.9	28	1.6	2.8	2.2	1.2	2.8	2.9
13	2.6	1.3	2.55	2.7	1.9	3.0	29	1.6	3.0	2.1	2.0	2.7	2.6
14	2.0	1.1	2.5	1.8	1.7	3.1	30	1.4	3.2	2.1	2.1	2.9	2.6
15	2.0	1.4	2.4	1.8	1.6	3.1	31	.....	3.2	.....	2.0	3.0	.....
16	2.1	1.4	2.35	1.7	1.6	3.2							

NOTE.—June 7-10 the canal was bank full. A discharge of the maximum capacity (28 second-feet) was assumed.

Monthly discharge of Matheson canal near Chinook, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April (29 days)	15.3	1.0	5.8	334
May	17.7	0	5.5	338
June	28.0	2.3	9.3	553
July	16.0	0	3.4	209
August	6.1	0	1.6	98
September	7.3	1.6	5.1	304
The season	.....	.....	.....	1,840

NOTE.—Values are approximate, owing to great and irregular fluctuation of daily stages.

HARLEM CANAL NEAR ZURICH, MONT.

The station was established in June, 1903. It is located about 500 feet below the head-gates of the canal, which are 1½ miles southeast of the Great Northern Railway section house at Zurich, and is best reached by driving from Harlem or Chinook. The gage was read during 1906 by George Henson. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 74, where are given also references to publications that contain data for previous years.

Discharge measurements of Harlem canal near Zurich, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 6	W. B. Freeman	8	4.5	0.48	0.90
April 9	do	22	36.9	2.20	40.2
April 19	Freeman and Morse	19	34.7	2.16	40.7
April 23	do	14	15.2	.95	8.6
May 5	W. B. Freeman			.25	*a*. 25
May 23	do	20	35.3	2.13	35.3

a Estimated.

Daily gage height, in feet, of Harlem canal near Zurich, Mont., for 1906.

Day.	Apr.	May.	June.	Day.	Apr.	May.	June.
1		0.3	3.3	17	*c* 0.8	0.5	
2		.3	2.9	18	.7	.5	
3		.3	2.2	19	*b* 2.2	.6	
4		.3	2.0	20	2.1	*b* 1.1	
5		.3	3.3	21	1.5	1.1	
6		.3	2.8	22	1.5	1.1	
7		.3	1.6	23	*c* 1.1	1.95	
8		.3	(*a*)	24	.6	2.0	
9	*b* 2.2	.3		25	.6	1.9	
10	2.1	.3		26	.3	1.8	
11	2.0	.3		27	.3	2.6	
12	2.3	.3		28	.3	2.85	
13	2.2	*b* 3.0		29	.3	3.45	
14	*c*. 8	2.1		30	.3	3.55	
15	.8	*c*. 95		31		3.45	
16	*b* 2.6	.5					

a Dam washed out. Canal closed for remainder of the season.
b Head-gate open.
c Head-gate closed.

Monthly discharge of Harlem canal near Zurich, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet
	Maximum.	Minimum.	Mean.	
April (9–30)	53.0	0.3	18.0	785
May	91.0	.3	21.2	1,300
June (1–7)	80.0	22.0	54.6	758
The season				2,840

NOTE.—Values are approximate, owing to great and irregular fluctuation of the daily stages.

AGENCY DITCH NEAR HARLEM, MONT.

The station was established July 14, 1905. It is located at the highway bridge about one-fourth of a mile below the head-gates. The gage was read during 1906 by J. W. Ijams. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 75.

Discharge measurements of Agency ditch near Harlem, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 10	W. B. Freeman	24	55.7	4.40	49.8
April 21	Freeman and Morse	20	31.1	3.38	10.6
April 27	W. B. Freeman	22	39.2	3.76	23.6
May 10	do	24	57.1	4.50	48.1
July 21	Morse and Hartman	24	41.7	4.34	6.5

Daily gage height, in feet, of Agency ditch near Harlem, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	4.1	5.7	3.85	3.6	3.8	17	4.2	4.5	3.35	4.5	3.5	3.9
2	.....	4.37	5.55	3.8	3.6	3.8	18	4.05	4.5	3.4	4.5	3.5	3.9
3	.....	4.32	5.15	3.7	3.6	3.8	19	3.8	4.5	3.85	4.4	3.5	3.9
4	.....	4.4	5.0	3.65	3.6	3.8	20	3.58	4.5	4.0	4.4	3.5	3.9
5	.....	4.4	4.8	3.6	3.6	3.8	21	3.4	4.7	4.0	4.15	3.5	3.9
6	.....	4.4	4.7	3.5	3.6	3.8	22	3.3	4.7	4.0	3.95	3.5	3.9
7	.....	4.4	4.55	3.4	3.6	3.8	23	3.22	4.65	4.2	3.7	3.5	3.9
8	.....	4.4	4.3	3.3	3.6	3.8	24	3.4	4.6	4.35	3.7	3.5	3.9
9	3.45	4.4	4.05	3.2	3.6	3.9	25	3.6	4.85	4.25	3.7	3.5	3.9
10	4.4	4.5	3.95	.....	3.6	3.9	26	3.68	4.55	4.2	3.7	3.5	3.9
11	4.65	4.5	3.85	.....	3.6	3.9	27	3.75	4.25	4.15	3.7	3.5	3.9
12	4.6	4.65	3.7	.....	3.6	3.9	28	3.85	4.05	4.0	3.7	3.5	3.9
13	4.35	5.05	3.6	.....	3.5	3.9	29	3.9	4.25	4.1	3.7	3.6	3.9
14	4.2	5.35	3.5	4.4	3.5	3.9	30	4.0	5.65	4.0	3.6	3.7	3.9
15	4.2	4.95	3.4	4.45	3.5	3.9	31	.....	5.95	.....	3.6	3.8	.....
16	4.35	4.65	3.4	4.5	3.5	3.9							

FORT BELKNAP CANAL NEAR CHINOOK, MONT.

The station was established June 21, 1903. It is located at the highway crossing 1 mile below the head-gates of the canal and is reached by driving. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 77, where are given also references to publications that contain data for previous years.

Discharge measurements of Fort Belknap canal near Chinook, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 5	W. B. Freeman	42	75.8	3.68	134
April 11	do	36	65.3	3.46	107
April 18	Babb and Morse	34	59.8	3.25	105
April 18	Babb and Freeman	34	59.8	3.25	106
April 22	Freeman and Morse	24	28.8	2.23	26.6
April 24	do	26	32.0	2.29	29.0
May 8	W. B. Freeman	8	2.3	.72	.91
May 22	do	30	52.2	2.93	64.6
July 3	do	20	16.3	1.62	11.0
July 20	H. M. Morse	30	47.8	2.85	61.6
July 27	W. S. Hartman	27	36.5	2.45	22.3
August 11	H. M. Morse	21	20.2	1.82	4.84
August 24	do	29	44.0	2.71	12.2
September 4	W. S. Hartman	13	6.3	1.05	5.46
September 21	do	24	28.5	2.11	14.7

Daily gage height, in feet, of Fort Belknap canal near Chinook, Mont., for 1906.

Day.	April.	May.	June.	July.	Day.	April.	May.	June.	July.
1	3.8		3.4	[a] 1.9	17	3.6			3.25
2	3.6		3.4	1.9	18	3.15			3.2
3	3.6		3.4	1.9	19	2.68			3.05
4	3.4		3.4	1.9	20	2.4			2.85
5	3.65		3.4	1.9	21	2.35	[a] 2.8		2.95
6	3.9		3.4	1.9	22	2.3	3.0		2.85
7	3.65		[b]	1.9	23	2.1	2.58		2.75
8	3.6			2.2	24	2.05	2.6		2.6
9	3.55			2.7	25	2.18	2.7		2.3
10	3.5			2.7	26	2.0	3.4		2.2
11	3.46			2.85	27	1.8	3.6		2.0
12	3.55			3.15	28	[b]	3.7		1.9
13	3.55			3.4	29		3.85		[c]
14	3.85			3.3	30		3.85		
15	3.8			3.5	31		4.0		
16	3.6			3.25					

[a] Head-gate open. [b] Head-gate closed. [c] Practically dry for remainder of season

Monthly discharge of Fort Belknap canal near Chinook, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 1-27	163	15	95.9	5,140
May 21-31	237	43	127	2,770
June 1-6	130	130	130	1,550
July 1-28	147	7	50.9	2,830
The season				12,300

NOTE.—Values are approximate, owing to great and irregular fluctuation of daily stages.

RESER DITCH NEAR CHINOOK, MONT.

A temporary gaging station was established July 10, 1905. It is located about 1 mile below the head-gates of the ditch. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 79.

Discharge measurements of Reser ditch near Chinook, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 28	W. B. Freeman	7	3.2	2.08	1.6
June 6	Freeman and Hartman	10	13.0	3.02	8.5

Daily gage height, in feet, of Reser ditch, near Chinook, Mont.

April 28	2.08	June 1 [a]	2.07
May 27	3.00	June 2	2.05
May 28	3.00	June 3	2.08
May 29	3.25	June 4	2.07
May 30	3.00	June 5	2.03
May 31	3.00	June 6	3.00

[a] Dam was washed out during June flood of Milk River and ditch was closed for remainder of the season.

WEST FORK DITCH NEAR CHINOOK, MONT.

A temporary gaging station was established on this ditch June 16, 1905, about 200 feet below the head-gates. During 1906 the gage was read by C. A. Shuler. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 81.

Discharge measurements of West Fork ditch near Chinook, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 26	W. B. Freeman				0
May 29	do	12	15.6	3.66	20.0
June 26	W. S. Hartman	4	1.7	2.16	1.62
July 19	Morse and Hartman	7	5.2	2.65	5.38
July 25	W. S. Hartman	5	2.4	2.23	1.99
August 11	do				0

Daily gage height, in feet, of West Fork ditch, near Chinook, Mont.

May 29	3.3	June 14	3.5
May 31	4.3	June 15	3.4
June 1	3.9	June 22	2.8
June 2	3.7	June 26	2.15
June 4	3.3	July 10	[b] 3.1
June 5	3.95	July 11	3.05
June 6	3.8	July 12	3.0
June 7	4.0	July 13	3.0
June 8	(a)	July 19	2.9
June 12	[b] 3.8	July 20	2.8
June 13	3.6	July 25	2.25

NOTE.—No flow prior to May 28.

Monthly discharge of West Fork ditch, near Chinook, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May (2 days)			24.0	95
June (12 days)	26	2	17.9	426
July (7 days)	11	2	8.0	111
The period				632

NOTE.—Values are approximate, owing to great and irregular fluctuation of daily stages.

WINTER-ANDERSON CANAL NEAR CHINOOK, MONT.

This station was established April 22, 1906. It is 5 miles east of Chinook and one-half mile west of James Cook's house. On account of the small grade the current is rather sluggish at all stages. The bed is composed of mud and silts up during the season. Discharge measurements are made by wading a short distance above the gage. The gage, which was read daily during the irrigation season by Julius Bosch, consists of a rod situated a short distance downstream from the highway bridge crossing the canal. The bench mark is the head of a spike 0.3 foot above ground in the north side of corner fence post on the south side of the road 50 feet west of the gage; elevation, 8.58 feet above the gage datum.

[a] Head-gate closed. [b] Head-gate open.

Discharge measurements of Winter-Anderson canal near Chinook, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 22	Morse and Freeman	11	12.1	3.20	10.0
May 5	W. B. Freeman			2.25	[a] 7.5
May 23	do			2.45	[a] 1.0
June 12	do	9	35.5	3.61	22.3
June 27	W. S. Hartman	11	8.8	2.90	4.51
July 25	do				0

[a] Estimated.

Daily gage height, in feet, of Winter-Anderson canal near Chinook, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1		2.7	3.5	2.88	17			2.9	2.2
2			3.85	2.8	18		2.0	2.9	2.2
3		[a] 2.3	3.75	2.8	19			2.9	2.2
4		2.3		2.8	20		2.0	2.9	2.2
5			3.3	2.75	21		[b] 2.8	2.9	2.18
6			3.3	2.7	22			2.9	2.14
7		2.3		2.6	23	2.8	2.45	2.9	2.1
8			3.8	2.58	24		2.3	2.9	2.1
9		2.3		2.47	25	2.7	2.4	2.9	2.1
10			4.6	2.4	26			2.9	2.1
11		2.1	4.1	2.4	27	2.7	2.6	2.9	2.24
12			3.5	2.3	28	2.7	2.7	2.9	2.4
13			3.3	2.24	29		2.85	3.0	2.1
14		2.3	3.0	2.1	30	2.7		2.9	2.4
15			3.0	2.3	31		3.55		[c] 2.1
16		2.1	2.95	2.3					

[a] Head-gate closed. [b] Head-gate open. [c] Canal dry for remainder of season.

Monthly discharge of Winter-Anderson canal near Chinook, Mont., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April (23–30)	3.6	2.8	3.0	48
May	20.2	.0	2.1	129
June	68	4.7	14.9	887
July	4.6	.2	1.2	74
The season				1,140

NOTE.—Values are approximate owing to great and irregular fluctuation of daily stages.

ROCK CREEK CANAL NEAR HINSDALE, MONT.

The gaging station was established July 5, 1905. It is located about 300 feet below the head-gates of the canal. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 83.

Discharge measurements of Rock Creek canal near Hinsdale, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 9	W. S. Hartman	22	18.1	0.20	13.1
July 22	W. B. Freeman			.10	[a] 8.0
August 14	do			.45	[a] 1.0

[a] Estimated.

Daily gage height, in feet, of Rock Creek canal near Hinsdale, Mont., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	0.1	0.75	0.0	−0.3	−0.3	17	0.8	0.5	2.3	0.1	−0.3	−0.3
2	.....	.1	.6	.0	−.3	−.3	18	.7	.4	2.1	.1	−.3	−.3
3	.....	.1	.6	.0	−.3	−.3	19	.5	.2	2.0	.1	−.3	−.3
4	.....	.1	.7	.0	−.3	−.3	20	.5	.1	1.8	.1	−.3	−.3
5	.....	.1	1.0	.0	−.3	−.3	21	.4	.1	1.6	.0	−.3	−.3
6	.....	.05	1.0	.0	−.3	−.3	22	.4	.1	1.1	−.1	−.3	−.3
7	1.2	.05	2.4	.0	−.3	−.3	23	.3	.1	.5	.0	−.3	−.3
8	.8	.05	(a)	.0	−.3	−.3	24	.3	.1	.0	.0	−.3	−.3
9	.6	.05	(a)	.5	−.3	−.3	25	.2	1.95	.0	−.1	−.3	−.3
10	.1	.05	5.1	.4	−.3	−.3	26	.2	1.8	.0	−.1	−.3	−.3
11	.3	.05	(a)	.3	−.3	−.3	27	.2	1.3	.0	−.2	−.3	−.3
12	.5	.05	(a)	.2	−.3	−.3	28	.1	1.2	.0	−.2	−.3	−.3
13	.9	.05	6.9	.2	−.3	−.3	29	.1	1.2	.0	−.2	−.3	−.3
14	.9	.05	4.8	.2	−.3	−.3	30	.1	1.4	.0	−.3	−.3	−.3
15	.7	.1	2.6	.2	−.3	−.3	31	.....	1.3	.....	−.3	−.3	.....
16	.6	.4	2.5	.2	−.3	−.3							

[a] Above gage, maximum gage height 11 feet.

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements were made in the Milk River basin in 1906:

Miscellaneous discharge measurements in Milk River drainage basin in 1906.

Date.	Stream.	Locality.	Area of section.	Gage height.	Discharge.
			Sq. ft.	*Feet.*	*Sec.-ft.*
July 3	Clear Creek	Yantic	26	.....	67
July 6	Snake Creek	Harlem	5.8	.....	5.8
July 12	Beaver Creek	Gravel crossing 10 miles south of Lake Bowdoin.	.....	.....	20
July 16	Larb Creek	Near Malta	.....	.....	2.0
July 19	Milk River	Glasgow	490	.....	430
July 20	West Fork Milk River	1 mile below West Fork ditch dam at ford.	.....	2.40	10
July 24	White Creek	Mills's ranch	.....	.....	.25
July 23	Frenchman Irrigation Company canal.	Saco	3.5	.....	2.3
July 24	Frenchman Creek	Saco, 5 miles above mouth	40	.....	50
July 25	Cottonwood Creek	18 miles northeast of Malta	.....	.....	5.0
July 25	Whitewater Creek	Upper reservoir	.....	.....	4.0
July 27	Alkali Creek	5 miles west of Malta	.....	.....	1.0
July 27	Peoples Creek	Fort Belknap Indian Reservation.	.....	.....	6.0
July 31	Havre Irrigation Company canal.	Fort Assinniboine	5.4	.....	6.0
July 31	Beaver Creek	do	5.8	.....	6.8
July 31	do	Pacific Junction	5.2	.....	5.6
June 29	Fifteenmile Coulee	Zurich	8.4	.....	8.8
June 29	Sixmile Coulee	½ mile above mouth	4.0	.....	4.8
June 29	Threemile Coulee	Chinook	4.3	.....	4.7
April 23	Milk River	Below Harlem canal	23	1.32	46
May 5	do	do	41	1.58	60
May 23	do	do	30	1.41	50

FLOODS IN MILK RIVER BASIN.

By William B. Freeman.

FLOOD OF JUNE 6 13, 1906.

In the early part of June, 1906, occurred the most destructive flood ever witnessed in the Milk River Valley since its settlement. The flood was brought about by very excessive precipitation over the entire lower drainage basin of the river at that time, following a somewhat abnormal rainfall in the latter part of May.

PREVIOUS FLOODS.

On a few occasions in the past the water in the main channel of the river has risen to a much greater height in the upper portion extending from Havre to Malta. These floods, however, have taken place in the early spring and have been caused by the rapid run-off from melted snow, accompanied by ice gorges. It is doubtful whether during the twenty-five years the valley has been inhabited there has ever been so large an actual flow of water in the lower part of Milk River as in the 1906 flood, and it is certain that many of the tributary creeks and coulees have never risen to such an excessive height.

In the flood of March, 1899, Milk River was out of its banks nearly the whole length of the valley, and most of the towns along it were partly or wholly submerged. From high-water marks in the streets of Havre the maximum gage height was estimated to be 18.80 feet, an elevation of 2,480 feet above sea level, Havre datum. The Great Northern Railway suffered great damage through washouts and loss on account of delays, while the private loss and inconvenience resulting from the flooding of houses, etc., was quite large. There was also considerable loss of domestic stock, but the damage to farm lands was small at such an early season. At this time Milk River reached a stage above any previous one within the memory of the oldest inhabitant. However, people who have lived in the vicinity of Glasgow for twenty years or more state that, at the time of their arrival in the country, there were drift logs and other high-water marks at least 2 feet above the 1899 mark. It is not known how this flood was brought about, but it is probable that it occurred within the last thirty years.

From the best authority it would appear that at Glasgow the flood height of the river in the 1906 flood was a few inches higher than in 1899, while at Havre at was several feet lower.

DRAINAGE AREA.

Milk River rises in the foothills in northwestern Montana near the west slope of the Rockies. At Havre, about 200 miles below the

head, it has a drainage area of 7,300 square miles, made up of hills and rolling plateaus; there is practically no wooded or mountain country in this area. During the June flood, 1906, only about 2,500 square miles above Havre were affected by a large rainfall.

Between the last-named point and Glasgow the river drains a large strip of country extending from the Bear Paws and Little Rockies on the south to the Cypress Hills in Canada on the north. The valley of Milk River throughout this distance of 150 miles has an average width of from 2 to 3 miles, while many of its tributaries, notably Beaver Creek, Larb Creek, Frenchman, Whitewater, and others, have also wide valleys. The lower drainage area of the river is similar in a general way to that above Havre, except for the broad valleys and the large percentage of comparatively flat bench lands. Except for a somewhat straggling growth of cottonwoods and willows along the different streams, practically no timber is to be found. The estimated drainage area of Milk River at Malta is 14,040 square miles, while at Glasgow it is approximately 23,600 square miles. Among the most important tributaries of lower Milk River are Big Sandy Creek (near Havre), Clear Creek, North and West Forks of Milk River, Thirtymile Creek, Snake Creek, Peoples Creek, Alkali Creek, Beaver Creek, Larb Creek (a branch of Beaver Creek), Big Cottonwood Creek, Whitewater, Frenchman, Rock Creek, Brazil Creek, and Willow Creek. In addition, there are numerous other small creeks and coulees, most of which were bank full or overflowing during the flood.

The United States Geological Survey has established gaging stations on Milk River at Malta and Havre, Beaver Creek near Ashfield, North and West Forks of Milk River near Chinook, and Rock Creek near Hinsdale. The record on the Milk at Havre extends over a period of nine years, on the Milk at Malta and Beaver Creek of less than five years, while the other stations have been maintained for very short periods.

RAINFALL.

This flood was preceded by a time of drought extending over a period exceeding two years, while the months immediately preceding were especially dry. It commenced to rain about the middle of May and from that time until the end of the month the average precipitation in the valley was from 4 to 5 inches, much above the average for the month of May. This was followed by an average rainfall of nearly 4 inches from June 6 to 13, inclusive, considerably over half of which fell in twenty-four hours. The ground was already thoroughly saturated, while all the water holes and reservoirs had been filled wholly or in part. This fact taken in connection with the enormous drainage area accounts for the large volume of run-off water.

There are four Weather Bureau stations within the area affected by the flood, all in the river valley, viz, Havre, Chinook, Malta, and Glasgow. The first-named is a regular station while the others are maintained by voluntary observers.

In the following table is given the daily precipitaion at each of these stations during the flood period and that immediately before and after:

Precipitation, in inches, at stations in Milk River basin during May and June, 1906.

Date.	Havre.		Chinook.		Malta.		Glasgow.	
	May.	June.	May.	June.	May.	June.	May.	June.
1	0	0	0.30	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0.29	0	0	0	T.	0	0	0
4	0	0.04	.....	0	0	0	0	0
5	0	0	0	0	0	0.10	0	0
6	0	0.46	0	0.94	0	0.98	0	2.30
7	0	1.36	0	2.17	0	3.22	0	0.95
8	0	0.21	0	0.42	0	0.38	0	0.52
9	0	0	0	0	0	0	0	0.20
10	0	0.08	0	0.07	0	0	0	0.06
11	0	0	0	0	0	0	0	0
12	T.	0.42	0.57	0.25	T.	0	0	0
13	0.24	0.06	0.09	0.07	0.80	0.53	0.48	0.67
14	0.01	0	0	0	T.	0	0.76	0.22
15	0.09	0	0.24	0	0	0	T.	0
16	0	0.03	0	0	T.	0	0.06	0.05
17	0.03	0.08	0	0	0	0	0.02	0.18
18	0	0.08	0	0	0	0	0	0
19	0	0.23	0	0.14	0.80	0.29	0	0.23
20	0.11	0	0.36	0.35	0	T.	0.05	0
21	0.15	0.43	0.21	0	T.	0	0.46	0
22	T.	0.31	0	0.30	0.06	0.79	0.13	0.32
23	T.	0.11	0.04	0.05	1.05	1.10	1.41	1.07
24	0.65	0.02	0.65	0	0.80	0	0.13	0
25	0.31	0	0.45	0	0.21	0	0.55	0
26	0.35	0	0.06	0	0	0	0.71	0
27	0.05	T.	0.32	0	0	1.94	0.08	0
28	0.09	0.45	0.05	0.91	0.21	0	0.19	0.35
29	0.41	0	0.39	0	0.47	0	0.01	0
30	0.54	0	0.58	0	0.25	0	0.60	0
31	0	.....	0.08	.....	0	.....	0.05	.....
Total	3.32	4.37	4.39	5.67	4.65	9.33	5.69	7.12

In the following tables is given the monthly precipitation at these stations for 1906 and for three years previous, as well as the average monthly precipitation:

Monthly precipitation, in inches, at stations in Milk River basin, 1903–1906.

HAVRE.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1903	0.33	0.21	0.52	0.95	3.47	1.51	5.23	2.52	0.48	0.21	0.50	0.10	16.03
1904	0.15	0.57	0.86	0.34	2.24	2.29	0.43	0.51	0.26	0.51	T.	0.45	8.61
1905	0.85	0.14	0.15	0.70	0.83	1.72	0.86	0.30	0.12	0.37	0.60	0.12	6.76
1906	0.17	0.11	0.31	0.09	3.32	4.37	0.17	1.63	0.93	0.57	0.74	.....	.....
Normal	[a] 0.62	0.48	0.55	0.97	1.98	2.90	2.08	1.32	1.11	0.64	0.74	0.54	14.25

CHINOOK.

1903	.....	.....	0.48	0.67	3.40	1.52	2.78	2.03	0.54	0.28	0.02	0.05	.....
1904	0.11	0.36	0.81	0.58	2.11	2.26	0.73	0.83	0.25	.....	.....	0.77	.....
1905	0.71	0.08	T.	0.25	2.00	3.50	2.66	0.41	0.48	0.55	.....	T.	.....
1906	0.04	0.05	0.15	0.35	4.39	5.67	0.00	1.83	0.94	0.56	0.26	.....	.....
Normal	[b] 0.46	0.38	0.52	0.66	2.76	2.60	1.44	1.17	0.78	0.57	0.80	0.46	.....

[a] Twenty-four years record. [b] Normal monthly from records of from three to ten years.

Monthly precipitation, in inches, at stations in Milk River basin, 1903–1906—Cont'd.

MALTA.

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1905[a]	.....	.....	.....	.....	2.22	3.80	2.31	0.01	0.37	0.40	0.55	0.04	.....
1906	0.02	0.00	0.02	0.25	4.65	9.33	0.00	1.12	1.86	0.50	.....	.....	.....

GLASGOW.

1903	0.17	0.07	0.18	0.12	5.33	.....	1.37	1.02	0.14	0.09	0.44	0.07	.....
1904	1.50	0.55	4.06	0.75	0.70	1.59	0.35	0.42	0.21	0.22	.....	1.44	.....
1905	0.13	0.22	0.65	.....	.....	.....	2.47	0.18	0.72	0.10	0.30	0.17	.....
1906	0.06	0.05	0.14	1.92	5.69	7.12	0.34	1.26	1.78	.....	0.25	.....	.....
Normal	[b] 0.51	0.63	1.46	1.02	2.55	2.49	0.88	0.48	0.64	0.79	0.75	0.54	.....

[a] Station established May, 1905. [b] Record from ten to thirteen years.

DISCHARGE.

The following table gives the daily discharge at the various regular stations maintained by the United States Geological Survey in the Milk River Valley from May 1 to July 15, 1906, inclusive:

Daily mean discharge, in second-feet, of streams in Milk River basin, May 1 to July 15, 1906.

Day.	Milk River at Havre.			Milk River at Malta.			North Fork Milk River at Chinook.			Beaver Creek at Ashfield.		
	May.	June.	July.	May.	June.	July.	May.	June.	July.	May.	June.	July.
1	38	712	390	0	1,800	2,000	24	890	175	.....	695	3,700
2	38	610	360	1	2,800	1,600	24	491	155	.....	1,230	1,670
3	24	560	360	1	3,310	1,260	24	367	144	.....	1,290	365
4	46	560	275	0	1,800	1,000	24	261	130	.....	660	195
5	38	610	190	0	1,330	875	24	179	115	.....	365	139
6	38	512	190	0	1,330	751	24	139	97	.....	202	98
7	38	660	160	0	1,330	691	21	2,050	95	.....	450	78
8	38	3,690	140	0	10,400	631	21	4,600	90	.....	5,000	50
9	32	2,970	110	0	10,900	517	18	1,040	85	.....	6,650	34
10	32	1,780	100	0	10,700	463	18	1,320	79	.....	6,100	25
11	32	2,310	100	0	9,840	412	16	1,230	73	.....	5,500	36
12	32	1,860	100	0	10,400	364	14	1,400	69	.....	5,000	28
13	32	1,550	78	0	10,300	210	12	2,130	62	.....	3,700	20
14	43	1,070	67	0	8,700	280	12	715	57	.....	2,120	16
15	32	865	67	0	6,890	180	12	453	55	.....	590	17
16	46	700	.....	0	4,450	.....	12	828	.....	.....	315	.....
17	55	600	.....	0	2,600	.....	12	275	.....	.....	270	.....
18	46	550	.....	0	2,000	.....	10	227	.....	.....	220	.....
19	38	600	.....	0	1,700	.....	16	196	.....	.....	164	.....
20	38	420	.....	0	1,400	.....	15	212	.....	.....	132	.....
21	97	420	.....	0	1,200	.....	48	155	.....	.....	95	.....
22	46	460	.....	0	1,100	.....	38	137	.....	.....	70	.....
23	38	550	.....	0	1,100	.....	34	206	.....	.....	78	.....
24	46	460	.....	6	1,230	.....	64	206	.....	.....	78	.....
25	104	420	.....	9	1,430	.....	118	212	.....	30	63	.....
26	120	550	.....	691	1,730	.....	118	296	.....	280	47	.....
27	138	460	.....	691	1,600	.....	96	265	.....	785	44	.....
28	183	500	.....	463	4,610	.....	144	244	.....	1,380	55	.....
29	239	550	.....	463	3,840	.....	310	307	.....	1,500	202	.....
30	686	480	.....	1,200	2,740	.....	1,750	228	.....	1,010	4,000	.....
31	1,230	.....	.....	1,330	.....	.....	1,720	.....	.....	935	.....	.....

NOTE.—For daily discharge of West Fork of Milk River see p. 48.

RUN-OFF.

The percentage of the run-off from some of the larger drainage areas averaging less than 10 per cent of the rainfall is surprisingly small. This is especially so in consideration of the fact that the soil was thoroughly soaked by rains a short time previously. It can be accounted for only by the large percentage of gravelly soil and comparatively flat bench lands. In this connection it may be stated that, on comparing the run-off from the whole drainage area of the Milk at Havre with the Havre rainfall from 1899 to 1905, inclusive, it has been found that the average annual run-off is only about 4.5 per cent of the rainfall.

The rainfall at Chinook represents about the average for the drainage area of Milk River at Malta for the flood period from June 6 to June 13. On this basis the following table has been prepared.

Ratio of run-off to rainfall in Milk River basin, June 6–13, 1906.

Stream.	Drainage area.	Rainfall.	Approximate run-off.		Ratio of run-off to rainfall.
			Acre-feet.	Inches.	
	Sq. miles.	*Inches.*			
Milk River at Havre	[a] 2,500	[b] 2.59	30,400	0.23	0.089
West Fork of Milk River at Chinook	1,318	3.92	24,000	.34	.087
North Fork of Milk River at Chinook	1,422	3.92	27,600	.36	.092
Milk River at Malta	[a] 9,200	3.92	129,000	.26	.066

[a] Drainage area affected by flood only, not total area of river.
[b] Havre rainfall.

The following data are interesting as showing the rates of maximum discharge during this flood, though the discharges in most cases are but estimates made from measured flood cross sections, slopes of stream beds, and velocities, computed by Kutter's formula:

Maximum discharge and run-off in Milk River basin, June 6–13, 1906.

Stream.	Locality.	Approximate drainage area.	Maximum discharge.	Run-off per square mile.
		Sq. miles.	*Sec.-feet.*	*Sec.-feet.*
Fifteenmile Creek	Chinook	40	1,650	41
Frenchman Creek	Saco	1,700	6,500	4
Fogey Creek	Harlem	25	375	15
Le Noir Coulee (on Beaver Creek)	Malta	16	8,600	538
Milk River	Havre	[a] 2,500	4,000	1.6
North Fork of Milk River	Chinook	1,432	7,700	5.4
Milk River	Malta	[a] 9,200	11,250	1.2
West Fork of Milk River	Chinook	1,318	3,000	2.3
Rock Creek	Hinsdale	976	18,000	18
Savoy Creek	Savoy	93	1,800	19
Second Creek (on Larb Creek)	Saco	25	1,700	68
Threemile Coulee	Chinook	26	1,750	67
Wayne Creek	Harlem	95	3,200	34
Yadley Coulee	Malta	[b] 20	2,750	138

[a] Only this area affected by flood. [b] Estimated.

EXTENT OF FLOOD.

Commencing on the night of June 6 the various tributaries of Milk River rose rapidly, though some of the longer ones did not reach their maximum until June 10. During the interval a flood condition existed from Fort Assinniboine to Glasgow, aptly described in the headlines of the Great Falls Tribune for June 9, "Milk River Valley One Big Lake."

In the vicinity of Assinniboine and Pacific Junction the whole bottom was submerged by the flood waters of Beaver Creek, while the Great Northern tracks were under water in many places. The flat at Yantic was covered by the waters of Clear Creek. The West and North forks of Milk River overflowed the valley east of Chinook, while Thirtymile Creek submerged the country east and west of Harlem, a part of the town, and a considerable length of the Great Northern tracks. Saco and all the country above was covered for days by the waters of Beaver Creek, while much of the country between there and Hinsdale was also flooded. Rock Creek was out of its banks by several feet, and the other streams were correspondingly high.

Traffic on the Great Northern from June 6 to June 9 was practically suspended on account of washouts and submerged tracks, while it was several days more before the road could resume its schedule. The highways in the valley, and especially along the railway track, were impassable for days, many of them being under several feet of water.

Between Malta and Glasgow Milk River was out of its banks in many places, overflowing the bottom lands, while the south side of Glasgow was flooded.

Many people living along the banks of the river and its tributaries were forced to leave their homes, but no loss of life resulted directly from the flood.

The following extract is taken from the Great Falls Tribune for June 9, 1906:

Reports received by the Tribune last evening from the flooded country in Chouteau and Valley counties show increasingly bad conditions, and there is every reason to fear even greater floods, as the dams of many great reservoirs have gone out, releasing millions of gallons of impounded water that will flow into the Milk River. * * * The country around Harlem and Chinook is a solid lake; scarcely a fence post is visible along the Great Northern in places. At Glasgow many are moving from their homes to higher land. Harlem and Hinsdale are full of refugees, and at Hinsdale the only available boat is being used to rescue imperiled ranchers and their families for several miles in every direction.

Thousands of sheep have been drowned, and there is every reason to fear enormous loss of lambs.

The rainfall at places in Valley County since May 1 has been 11 inches—nearly equal to the normal annual rainfall.

DETAILS OF FLOOD, BY BASINS.

Milk River.—The damage done by Milk River itself in this flood was comparatively small. Several small railway dams at water-tank pumping plants were washed out, while one or two small railway pumping plants were injured. All of the bridges on the river stood the flood in good shape.

There are five irrigation dams between Havre and Harlem, three of which are brush and rock-fill structures. One of these latter, the Harlem dam, was taken out about 4 a. m. on June 8. It failed by the water cutting through between the dam and the left or north bank, as there was no sheet piling nor other protection against this action. The material composing the bank is of a sandy formation and melts away before the action of water. The space cut through was gradually enlarged to a width of nearly 100 feet. Only a small portion of the end of the dam was washed away. The structure was about 10 feet high and 200 feet long, built on the style of a beaver dam at a cost of $4,000. It has been found that dams of this type, when properly joined to the banks and after they have settled, resist the action of water in a remarkable manner. This can be seen from the number of such structures that resisted this one flood.

The Fort Belknap Indian Agency dam near Harlem, a rock-fill timber structure, worth about $25,000, was slightly damaged, and it was necessary to do considerable work on the banks in the way of riprapping to prevent the water from cutting a channel around it.

The Paradise Valley dam, the Winter-Anderson dam, and the Belknap dam near Yantic were practically unharmed by the flood waters. The first two are of the brush type, the second being a comparatively small, cheap structure. The Belknap dam is in the main a timber, rock-fill dam, 7 feet high, with a spillway of about 130 feet. It was last built in 1904, at a cost of $5,000.

The banks of the river were scoured and cut away for considerable distances in many places, while a shifting of the bed and channel of the stream was also very apparent.

The river was bank full from Chinook to Malta and between Malta and Glasgow it was over its banks at low places, flooding the bottom lands to a depth of several feet in different localities. Many ranches and houses were under water and there was the usual loss of domestic stock, etc. It is probable, however, that the total damage done by the Milk River itself did not exceed $30,000.

At Glasgow the water rose to the backyard of the court-house, and at Malta a gage height of 19 feet was attained. (See p. 81 for elevation of high water at different points on this stream.)

Beaver Creek (Chouteau County).—This creek was at a high stage during the early June flood and continued to do damage for several days

after its first subsidence on account of cloud-bursts, etc. The stream was out of its banks for a long distance along its course. Part of the flood water rushed down the Havre Irrigation Company's ditch, the head gates of which were open, and scoured the upper portion, and broke through the banks in many places. The small dam at the head of this ditch was also practically destroyed. The waterway provided through the Montana Central track was apparently insufficient. For over a day the water was running over it to a depth of a foot or more. For several days there was a large pond formed above the track exceeding one-fourth mile in width. The wave action from this lake, probably in connection with the rush of water, did considerable damage to the embankment for a distance of 300 to 400 yards west of Assinniboine Station. The upper side of the embankment was badly eroded and the ballast was washed from under the ties. The track was washed through at one place about one-fourth mile east of the station, and a section of the main-line track of the Great Northern was taken out at Pacific Junction by this creek, and traffic was delayed for several hours on different occasions. The greater part of the damage done by this creek was sustained by the Great Northern.

The drainage area of the stream is estimated at from 40 to 50 square miles, of which the greater part is situated in the Bear Paw Mountains. A conservative estimate of the maximum discharge in the flood is 4,000 second-feet. A flood cross section taken 1 mile below Fort Assinniboine showed an area of 1,300 square feet. With the slope of 7.5 feet per 1,000 feet, obtained from topographic sheets, and an assumed coefficient of roughness of 0.045 in Kutter's formula, the velocity was found to be 8.0 feet per second; but on account of the shape of the channel at this point and for other reasons it is believed to have been not much in excess of 3 feet per second.

Red Rock Coulee.—This coulee was reported to be out of its banks and overflowing considerable land along its course. The channel of the Fort Belknap canal was filled by the flood waters, but the canal was practically undamaged. The Ross and MacClaren reservoirs on the coulee were destroyed. The drainage area of the coulee is over 40 square miles and the flow of water was no doubt considerable, though no estimate of it was made.

West Fork of Milk River.—This stream had been over its east, or left, bank for a couple of days in the latter part of May, the overflowing water escaping eastward through a slough. In the flood from June 8 to 11 it reached a much higher stage. The water went over the right, or west, bank also, flooding a large area, including the north side of Chinook, which was submerged for a couple of days, forcing people to temporarily abandon their homes. The maximum gage height attained was 17 feet, at which height it is probable that

not over half the total flow was contained within the banks of the creek. It is estimated that the maximum flow in this flood was 3,000 second-feet.

On June 7 at 2 p. m. the Reser Irrigation dam on this stream, about 12 miles north of Chinook, was washed out. The water tore through the center of the structure, taking everything bodily for a width of about 40 feet. This dam was a timber-crib, rock-fill dam of the weir type. It was built in 1904 at a cost of probably $1,500. The width of the spillway was about 90 feet, and as the left bank is low there was an extension earthen embankment on that side. The structure was firmly joined by sheet piling to the right bank and to the earthen embankment at the left. On Friday, June 8, the breaking of the Garthofner and Hedge reservoir dams on a branch of West Fork caused an enormous amount of impounded water to be let loose. The loss due to the destruction of these two dams was about $3,000. Probably the only dam left standing on this creek was that of the West Fork Irrigation Company, a rock-fill timber structure last built in 1904. Including the cost of the old brush dam, part of which still remains, the total cost was about $2,500. It has a width of spillway of 80 feet.

The total damage done by the flood on this stream is estimated at $15,000.

North Fork of Milk River.—During this flood the North Fork reached a height much greater than any within the memory of the oldest inhabitant. The maximum gage height attained during the night of June 7 was 16.63 feet. The flood area of the cross section at the gaging station was 1,500 square feet and the discharge, estimated from Kutter's formula (using a slope of 4 feet per mile and an assumed n=.035), was 7,700 feet.

Even at this point, which is well up in the hills, the stream overflowed its right bank, while the lower portion of the creek for 5 to 6 miles above its mouth was out of its banks and overflowed surrounding fields. The high-water mark is within 3 feet of the level of the floor, at the highest point, of the county highway bridge along the Great Northern Railway, and within 5 feet of the bottom of the plate-girder railway bridge.

The Matheson dam, on this stream, was badly damaged, the Matheson canal was entirely under water, and all the bridges and flume crossings along it were washed out, though no great damage was done to the canal. The railway embankment was damaged but slightly, but the highway along it was completely submerged, rendering travel impossible.

By far the greatest loss on North Fork was that due to the drowning of stock, especially sheep. Several outfits were "lambing" at various places along this stream and the tributary coulees. In many

cases it was impossible for them to move out before they were surrounded by the rising waters. Thousands of lambs were thus entrapped and drowned, while many others perished in the storm. Not a few sheep perished in the same manner.

Outside of the stock loss, which is large but difficult to estimate, the total damage done by the flood waters of this creek probably did not exceed $5,000.

Thirtymile (or Parallel) Creek.—Probably as much damage was done by this creek as by any of the tributaries of Milk river. It usually carries considerable water during the spring floods, but is dry as a rule for the remainder of the year except during heavy storms. At intervals of a mile or two along its lower course earthen dams have been built to divert and store the run-off water. These dams have the effect of raising the water and causing the banks of the stream to overflow from a much smaller flow than they otherwise would. Of course the stream channel is entirely inadequate in any case to carry any large amount of flood water. At a point a few miles above Harlem the flood cross section was found to be 1,950 square feet and the estimated discharge was 8,880 feet.

It started to rain at Harlem on the morning of June 6 and poured incessantly for twenty-four hours. Early on June 7 the creek was out of its banks and running over the north side of Harlem; people were commencing to leave their homes. The water rose rapidly until noon, when the whole north side was under from 2 to 4 feet of water. At that time there were nearly 1,000 second-feet flowing down the main street of Harlem, the water being above the hubs of an ordinary wagon. At 8 o'clock that evening it had fallen somewhat, and the next morning the creek was pretty well back into its banks. (Pl. V.)

The tracks of the Great Northern Railway prevented the water from flooding over the south side of Harlem. A sheet of water, backed up by the track, extended from nearly 2 miles above Harlem to 3 to 4 miles below. In the stock yards, a mile east of Harlem, there were 3 to 4 feet of water, and the right-of-way fence posts were invisible at points along the railroad. South of the railway track and east of Harlem a river 3 to 4 miles wide was flowing into Milk River. Many houses and ranches were surrounded or submerged to a depth of 3 feet or more. At low places along the railroad the water was almost on a level with it, and the upper side of the embankment was being cut away and the ballast washed from under the ties, causing the track to settle; at one or two trestles the embankment was washed through. Every bridge, trestle, and culvert in the track for a distance of 5 to 6 miles was carrying water to its maximum capacity, while the water level in the lake above the track was rising rather than falling. In order to allow the impounded water to escape and to save the track it was necessary to cut channels through it in several places.

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FLOOD OF JUNE 7, 1906, AT HARLEM, MONT.

The following clipping is taken from the Great Falls Tribune of June 8 regarding this flood:

Harlem, June 8.—One of the heaviest rainfalls that has ever been known in this part of the country fell in the Milk River Valley, beginning at 9 a. m. Wednesday. The town and entire valley is one solid lake of water. The residents on the north side of the railroad track had to be taken from their homes by wagons to hotels and other places of refuge. All cellars and most houses are filled with water. Bridges and railroad tracks are washed out and trains tied up all along the line. Considerable damage to sheep and stock is reported. Reports reached here this afternoon that Sprinkle Brothers' entire band of 4,000 sheep were drowned in Thirtymile Creek the past two days. Miles of railroad right-of-way fence are under water and every country road is a river. The damage to property and stock is estimated at $40,000.

The above estimate of the loss is probably rather large.

On Fifteenmile Coulee, which heads a short distance from Thirtymile Creek, there was also a great loss due to the drowning of stock.

Threemile Coulee.—The large earthen reservoir dam on Threemile Coulee, built by the Indian Department, was taken out during this flood. It was destroyed mainly by wave action in the reservoir. The cost of this structure was probably $2,000 to $3,000, and the damage done amounted to a few hundred. The reservoir has a length of over a mile and a width of about one-fourth mile. From approximate data on the time of filling the reservoir, it is believed that the maximum flow was nearly 2,000 second-feet and the run-off about 3,000 acre-feet.

Peoples Creek.—This creek was out of its banks for a long distance, and it is stated that all the country near its mouth into Milk River was a regular lake. A flood cross section was taken at the Ereaux ranch, about 3 miles from the mouth. Both banks had overflowed a short distance above the section, forming islands on both sides at that point. It is estimated that the maximum flow was in excess of 4,000 second-feet. As this creek rises in the Bear Paw and Little Rocky mountains, it is likely that there was considerable flow for several days. As a rule, it carries water for a long time after the other streams in the vicinity are dry.

Little damage was done by this creek, that due to the flooding of the bottom land being slight.

Beaver Creek (Valley County).—Beaver Creek carried an amount of water during the spring of 1906 greatly in excess of any discharge for several years. In the latter part of May the gage height at the gaging station was nearly 11 feet, while in the big June flood it rose to a height of about 12.60 feet, as shown by high-water marks; again in the latter part of June a height of over 12 feet was attained. In April, 1904, the gage height was within a foot of the highest for the present season, while the estimated maximum discharge is not much over a fourth that for 1906.

The maximum gage height attained by the Beaver Creek overflow channel on June 9 was 11.56 feet, while the discharge must have been considerably over one-half that in the main channel. Lake Bowdoin, which is supplied mainly by this stream, rose several feet in height and the water level was up along the railroad embankment for miles. The latter was badly scoured by wave action; the softening of the roadbed made travel necessarily slow and dangerous. A great area of bottom hay land on the south side of the track was included within the high-water contour of the lake, and, as the latter subsided slowly, part of this land was made valueless for the season. A portion of the north end of the Brady dam on this lake was washed out. The approximate high-water level of the lake for the season was 2,210.3, Havre datum.

On the upper waters of Beaver Creek great damage was done by the breaking of the reservoir dams of B. D. Phillips's irrigation system. It has been stated that this loss is in the neighborhood of $30,000.

All along Beaver Creek Valley the flood waters covered the whole flat, while many of the tributaries also carried enormous volumes of water. This was especially so in the later June flood, which was confined mainly to the lower tributaries. Among them may be mentioned Clanton and Le Noir coulees, which carried veritable rivers. The fall of these coulees is from 40 to 50 feet per mile and the flood waters rushing from them tore up the ground. It is estimated that Le Noir coulee, with a drainage area of 16 square miles, had a maximum discharge of 8,600 second-feet. This does not seem possible, but is based on flood cross sections and velocities computed by Kutter's formula. Between 100 and 200 acres on Sanford's ranch, at the mouth of the coulee, were submerged to a depth of several feet and the crops washed out of the ground. A great many hogs were drowned on this ranch by the flood waters. It is a peculiar fact that the Sanford reservoir dam on this coulee, an earthen dam 425 feet long, withstood the flood, though it was topped by the rushing waters to a depth of 1.5 feet.

Along the whole course of Beaver Creek and its tributaries it is probable that there was a great loss due to the drowning of stock.

The railroad dams at Ashfield and Saco, rock-crib structures, were practically put out of commission by the action of the successive floods.

The creek went out of its banks above Saco, and for days that town was under water, in many places the depth being over 3 feet, while the inhabitants went around the streets in rafts and boats. The elevation of the high-water level at Saco was 2,175, Havre datum.

All of the lower valley of Beaver Creek between Saco and the mouth was inundated. It is probable that the total damage done by the flood on this stream was fully $50,000.

Larb Creek.—This creek has a valley very similar to that of Beaver Creek, of which it is a tributary, and, as on that stream, the whole creek bottom was flooded. A flood cross section was taken about a mile above the mouth of Second Creek, from which the maximum discharge was estimated at 6,800 second-feet. Many of the tributaries also carried large amounts of water. Where Larb Creek emerges into the Beaver Creek flat the high-water line was in many places within 100 feet of the stakes of the proposed "A" line canal of the Milk River project.

The damage due to the flood waters of Larb Creek was not very great, though there was probably considerable loss of stock.

Hay and Buffalo coulees.—These coulees emerge from the hills south of Vandalia and have a drainage area of about 8 square miles each. On the evening of June 6, after the heavy rain, the water came down them with a great rush and soon the whole flat below was covered. The only outlet through the Great Northern Railway track provided for this water was a small trestle at the east end of the Vandalia switch, and some distance east of this a concrete culvert about 4 feet high and a cast-iron pipe about 40 inches in diameter. On account of hills to the east and west there was no other escape for the water than through these three openings, and the greater part of it went to the smaller ones. These were, of course, entirely inadequate to carry it, and the result was that the water was backed up nearly to the level of the track, the embankment of which is upward of 15 feet high in places. The upper side of the embankment was softened and a whole work train going across was overturned into this pond on account of the yielding of the track. A little later the track was washed out near the culvert for 100 feet or more and traffic was suspended for days.

Willow Creek near Glasgow.—The greatest damage done by the flood waters of this stream was the total annihilation of the Cutting-Patten-Truscott reservoir dam on the morning of June 7. In the latter part of May the reservoir had been filled to its maximum capacity during the heavy rains, but had not been appreciably damaged, though the Lenz dam, a smaller structure on the creek, went out.

At the time the first-named dam failed it is stated that the water-level was hardly as high as in the first flood, but its destruction was caused by the heavy wind which had been blowing incessantly against it for twenty-four hours preceding its failure. The dam was cut to pieces by the waves, which beat on it and over it, and by the subsequent rush of the impounded waters.

This dam was a well-made earthen embankment about 1,800 feet long, varying in height from 7 to 12 feet except at the creek channel, where it was probably 20 feet high. At that part of the dam there

was a center plank wall composed of 2-inch planking nailed to piles, and this portion of the dam was also puddled. The top width of the dam was 14 feet, the upstream slopes were 3:1 and the lower 2:1. The upstream side was riprapped with bundles of willows fastened at the water surface. There was ample wasteway provided at the left side of the dam. A conservative estimate of the loss due to the destruction of this dam is $10,000.

The reservoir comprises an area of about 400 acres. At one time before its destruction a rise of 3 inches per hour was noted in the reservoir, which would mean a discharge of 1,200 second-feet. It is probable that the maximum was at least twice that amount. The rise of the water surface in an ordinary flood was 4 inches in twenty-four hours.

A large area of country below the reservoir was flooded, and the highway bridge immediately below was taken out. The total flood loss on this stream was probably in excess of $20,000.

Rock Creek.—This stream rose to a great height during the early June flood. From high-water marks the maximum gage height was 18.35 feet, and it is estimated that the maximum discharge was 18,000 second-feet. At the Rock Creek Canal dam the creek channel could not begin to carry the water, and it was spread over the bottom for nearly a mile in width and to a depth of several feet. The height over the Rock Creek canal dam was about 9 feet, and it is estimated that the gage height was 11 feet on the Rock Creek canal gage. The headworks of the ditch were washed out, and the ditch bottom was badly scoured. It is probable that the canal was completely under water at places near the head. Several small structures along the canal were taken out and the embankment gave away at one or two coulee crossings.

The Rock Creek canal dam was not damaged in the least by the flood water. It is a very well-built rock-crib timber structure, the width at the crest being 140 feet, and the height above the creek bottom about 6 feet. It was built in 1902.

The total damage done by the flood on this creek was probably not in excess of $5,000.

Frenchman Creek.—Though this creek with its drainage area of 1,700 square miles is probably the most dependable tributary of Milk River, the maximum flood flow was not nearly as large as that for many of the smaller branches. Owing to the great length of the drainage basin, the flood waters from the lower portion had passed by before the waters from above came down. From a flood cross section it is estimated that the maximum flow during the present year was 6,500 second-feet. At the same point in 1903 a high-water mark about 1.50 feet above that of the present season was attained. Practically no damage to structures was done on this stream, though

there was no doubt some stock loss. The only important dam on this creek, that of the Frenchman Irrigation Company, was unharmed. This is a rock-crib structure 85 feet wide at the crest and 5½ feet high. It was built about 1899.

Whitewater Creek.—No estimate of the flood flow of this creek was made by Kutter's formula, but with its drainage area of 700 square miles the maximum must have been at least 3,500 second-feet. There are several small earthen dams along the course of this creek and two large mill-reservoir dams situated 13 and 18 miles, respectively, above the mouth of the creek. The upper dam was partly destroyed, a section 50 yards wide being taken out at the creek channel and the whole upper side of the embankment being badly pitted and caved by the wave action. The dam consists of an earthen embankment about 1,000 feet long. It is 25 feet high at the creek bed and from that point the height gradually diminishes until it runs out into the higher ground at the ends. The top width is between 10 and 12 feet and side slope 1½:1. It was completed in 1905 but has not been riprapped on the upper side. This is what probably led to its failure.

The lower dam was similar in construction to the other, but was riprapped with gravel and small bowlders. It withstood the wave action, though it was badly pitted. The water level in the reservoir was within 3 feet of the top of the dam. The length of the dam is 1,200 feet and the greatest height about 18 feet.

The total cost of these two dams was probably $15,000, and the damage done will amount to about $3,000.

Other streams.—At many places between Tampico and Glasgow the road as well as many fields were submerged by the flood waters of Antelope Creek, Brazil Creek, and intermediate coulees, or from the back water and overflow water of Milk River itself. Outside of a small amount of damage to buildings and the inconvenience resulting from the high water there was comparatively little loss on these streams.

The Mahon-Hoyt earthen reservoir dam on Brazil Creek was washed through in one place and damaged by the wave action to the extent of $500 or more.

Several streams to the north and east of Malta, such as Big and Little Cottonwood and Assinniboine creeks, rose to great heights, attaining their maximum probably in the later June flood. Every coulee and stream for miles was taxed to its maximum capacity and many overflowed their banks. As this area is sparsely populated little loss was sustained, though the roads were rendered impassable and several small bridges were washed out.

RÉSUMÉ.

The actual property loss resulting from this flood was probably about $250,000. Of this the Great Northern Railway Company

sustained a considerable amount, the greater part of which would have been prevented had ample waterway in their tracks been provided. The washouts were caused mainly by the water impounded by the track embankments.

A great many dams were destroyed, only a small percentage of the earthen reservoir dams on the tributaries of Milk River successfully withstanding the flood. Had these dams stood, a great deal of the submergence of the valley lands would have been prevented, though the combined capacities of all these reservoirs would have been entirely insufficient to store the run-off waters. The high wind which blew so steadily from the west during the greater part of the early June flood was in large measure the cause of the failure of most of these embankments, as they were not constructed in a manner to enable them to resist the action of waves for any continued period. The railway embankments were also badly scoured and pitted by the waves in the lakes formed above them.

Had the earthen dams been well riprapped a great many would probably have stood. However, to insure their safety, it would have been necessary for the riprap to extend from the upstream side, over the top, and down for a short distance on the lower face, as the waves in many cases beat over them when the reservoirs were full. The failure of one or two timber structures was unlooked for and could hardly have been avoided.

Had this flood occurred in a thickly populated community the damage would have unquestionably been large, but the area affected was very sparsely populated. In the total length of 200 miles of flooded country it is doubtful whether the population is in excess of 5,000 people.

A flood of this magnitude is not likely to occur again for many years. In that time the reservoirs destroyed will undoubtedly be rebuilt, in addition to many more. Profiting by this experience gained in this flood, people will probably build their dams more substantially, especially in the case of the larger ones, the destruction of which involves the loss of thousands of dollars. It would be a comparatively easy matter to store a large enough per cent of the run-off of a flood of this magnitude so that the remainder could easily be carried by the natural channels, the destruction of property thus being avoided.

Over large drainage areas in this vicinity the per cent of run-off is apt to be small, the immediate run-off not being much in excess of 10 to 15 per cent of the rainfall, while not a very large rate is to be expected. However, on very small areas covering from 10 to 20 square miles very excessive rates may occur, exceeding even 500 second-feet per square mile for short periods. This is especially true when the slopes are steep and the drainage area is comparatively broad.

The people in the Milk River Valley and the surrounding country at the present time do not depend primarily on farming and irrigation for a living. In the whole valley and its tributaries there are probably not over 50,000 acres of land which have any kind of irrigation which is to be depended on in the least. It is essentially a stock country. During the continued drought preceding this flood the range had been eaten off and dried up until it was practically barren. Most of the water holes, even, which are used for the watering of range stock, were dry. In the valleys there was likewise no moisture and no water for irrigation, and therefore the small hay crops obtained in 1905 were about to be followed by practically none in 1906. It was becoming evident that stock must either be left to starve or transferred to different ranges. The continued rains beginning the middle of May had the effect of transforming this barren waste into a veritable garden spot. The range grass sprang up again as if by magic, and at the end of the storm it was better than it had been for years. The stockman had been saved. The flood waters in many places in the valley, irrigating the hay fields as they ran over them, did a great deal more good than harm.

Though much stock, especially lambs, perished during this long storm, the benefits resulting to this industry many times offset the loss on the range and the damage done in the valley. Under the existing conditions in Milk River Valley this flood, therefore, was more beneficial than otherwise.

FLOOD OF JUNE 27, 1906.

On June 27, in the vicinity of Malta, there occurred a very excessive local rainfall of short duration. It covered a territory extending probably 15 miles east and west of Malta. The tributaries in that vicinity rose to a much greater height than in the early June flood, and in many cases to unprecedented heights. From the records of the voluntary weather observer at Malta the total precipitation in this storm was 1.94 inches, of which 1.75 inches fell in an hour and fifteen minutes.

Within a short time every stream and coulee was carrying a phenomenal amount of water. Coulees which had not carried water for years became rushing torrents. West of Wagner the waterways provided in the railway track were entirely inadequate, and the country north of it was a large pond. At the culvert 1½ miles west of Wagner the track was washed through for a distance of 100 yards.

Wagner was practically all under water. At the depot the level of high water was only about 3 feet below the general track level. East of Wagner there was a lake extending from the railroad track to the foothills and continuing along the track several miles. The highways were submerged at points both east and west of the station to a depth of 3 to 4 feet.

Exeter Creek carried an enormous volume of flood water, overflowing its banks and following along the railroad track for several miles to the east. At the culvert at Exeter siding, a short distance west of the main trestle crossing, a section of track was badly damaged, while the track was washed through at a trestle a mile or two to the eastward, delaying traffic for several hours. From the appearance of a field which was overflowed the velocity was evidently considerable.

A flood section, taken about 1 mile north of the railway track, shows an area of 880 square feet and the estimate discharge of 4,400 second-feet.

Yadley Coulee, a small tributary on the north side of Milk River, carried a remarkable amount of water in this storm. It was higher by several feet than at any time in the last fourteen years, and probably it was never at a higher stage. Where it emerges from the hills onto the flat the water was on a level with the floor of Davidson's house. This creek has a fall of over 50 feet to the mile, from which it would appear that the velocity was very large. Some idea of this can be gained from the fact that a large cottonwood tree in the coulee was torn out by the roots and carried for 300 yards onto the flat. A flood cross section taken about 1 mile above Davidson's house showed a total area of 430 square feet and the estimated discharge of 2,700 square feet.

There is no well-defined channel for this coulee after it leaves the hills, and it is stated that the flood waters followed along Milk River for a distance of 7 miles before entering it.

The cloud-burst also covered part of the drainage area of Beaver Creek, being especially violent on some of the western tributaries of this creek.

This flood evidently extended as far west as Dodson Creek, though the latter did not rise to as great a height as in the earlier June flood. Alkali Creek did not get as high by 4 feet as in the earlier flood. This was due partly to the fact that the washing out of several reservoir dams in the first flood caused a greater rush of water. The damage done on both of these last-named creeks probably did not exceed $5,000.

MAXIMUM DISCHARGE AND HEIGHTS OF WATER DURING THE FLOODS.

The following table gives the approximate flood cross section and maximum discharge of many of the streams in the Milk River Valley. They were computed from levels taken about a month after the floods occurred. The high-water marks used were in most cases quite reliable. The discharges are in the main based on velocities computed by Kutter's formula, using values of "n" varying between 0.035 and 0.050. In many cases, on account of backwater and for other reasons, other values have been used for the velocities than those computed. A few of the estimates of discharge are practically assumptions.

Estimated flood discharge of streams in Milk River basin, June, 1906.

Stream.	Locality.	Location of section.	Height of high water above stream bed.	Slope of stream bed per 1,000 feet.	Flood cross section.	Estimated maximum discharge.
			Feet.	*Feet.*	*Sq. ft.*	*Sec.-ft.*
Alkali Creek	Malta	½ mile above crossing of proposed Malta south canal.	16.50	1.0	970	5,300
Antelope Creek	Tampico	4 miles above Milk River, SW. ¼ sec. 32, T. 29 N., R. 38 E.	11.50	2.3	2,300	2,300
Assinniboine Creek	Malta	1 mile above Milk River, 7 miles north of Malta.	6.80	5.0	650	2,150
Beaver Creek	Ashfield [a]	At U. S. G. S. gage, 3 miles south of Ashfield. [b]	13.60	.....	3,350	6,650
Clanton Coulee	Branch of Beaver Creek.	SE. ¼ sec. 25, T. 30 N., R. 21 E.	10.00	4.2	1,180	4,250
Cottonwood Creek	do	Center sec. 10, T. 29 N., R. 32 E.	7.50	6.0	500	2,850
Le Noir Coulee:						
North Branch	do	SW. ¼ sec. 7, T. 29 N., R. 32 E.	7.2	10.0	450	3,600
South Branch	do	SW. ¼ sec. 7, T. 29 N., R. 32 E.	5.7	9.5	1,100	5,000
Lonetree Coulee	do	NW. ¼ sec. 27, T. 30 N., R. 32 E.	2.7	10.0	35	150
Smith Coulee	do	NW. ¼ sec. 20, T. 29 N., R. 32 E.	3.3	3.0	150	450
Beaver Creek	Fort Assinniboine	Fort Assinniboine Military Reservation, 1 mile north of Fort Assinniboine.	8.0	7.5	1,300	3,900
Big Cottonwood Creek.	Malta	T. 33 N., R. 30 E., 18 miles north of Malta, 1 mile north of main road to Malta.	13.5	1.0	3,450	10,000
Brazil Creek	Glasgow	1 mile south Mahon-Hoyt reservoir, NE. ¼ sec. 24, T. 28 N., R. 38 E.	10.5	.....	1,300	2,000
Buggy Creek	do	2 miles above Milk River, NE. ¼ sec. 29, T. 30 N., R. 38 E.	6.0	2.5	2,000	3,400
Cherry Creek	do	2½ miles north of Great Northern Rwy., NW. ¼ sec. 24, T. 29 N., R. 39 E.	10.2	1.5	330	1,240
Clear Creek	Yantic	1½ miles south of Yantic, SW. ¼ sec. 33, T. 33 N., R. 18 E.	6.0	7.6	700	2,000
Dodson Creek	Dodson	1 mile north of Great Northern Rwy., SW. ¼ sec. 29, T. 31 N., R. 27 E.	6.3	0.8	440	1,200
Eureka Creek	Haro	¼ mile north of Great Northern Rwy., T. 31 N., R. 26 E.	8.6	1.0	200	750
Exeter Coulee	Exeter	1 mile west of Exeter siding, 300 yards north of Great Northern Rwy.	3.3	10.0	45	250
Exeter Creek	do	1 mile north of Great Northern Rwy., SE. ¼ sec. 4, T. 30 N., R. 29 E.	7.7	2.8	900	4,400
Fifteenmile Creek	Zurich	50 yards south of Great Northern Rwy., NW. ¼ sec. 32, T. 33 N., R. 21 E.	8.2	3.0	425	1,650
Fogey Creek	Harlem	1 mile north of Great Northern Rwy., NE. ¼ sec. 15, T. 32 N., R. 23 E.	5.8	3.8	140	375
Frenchman Creek	Saco	At Taylor's ranch, NE. ¼ sec. 34, T. 33 N., R. 34 E.	13.00	2.5	930	6,500
Larb Creek	do	SW. ¼ sec. 11, T. 30 N., R. 34 E.	17.0	1.5	[c]5,900	7,000
First Creek	Branch of Larb Creek.	2 miles above Larb Creek, middle of sec. 28, T. 31 N., R. 34 E.	6.0	5.0	1,325	2,650
Second Creek	do	1½ miles above Larb Creek, SW. ¼ sec. 4, T. 30 N., R. 34 E.	6.8	2.0	170	1,700
Little Cottonwood Creek.	Malta	At ford on main road to Malta, north side of Milk River.	8.0	3.6	530	2,000
Milk River	Havre	Gaging station at Havre highway bridge. [d]	.....	.....	.....	4,000
Do	Malta	Gaging station at Malta highway bridge. [e]	20.0	.....	[c]2,800	11,250
Milk, North Fork	Chinook	Gaging station 4½ miles north of Chinook. [f]	17.3	0.75	1,500	7,700
Milk, West Fork	do	Gaging station ½ mile east of Chinook. [g]	.....	.....	.....	3,000
Peoples Creek	Dodson	At Ereaux's house, 3 miles above mouth, Fort Belknap Indian Reservation.	9.30	0.90	720	3,000

[a] Beaver Creek Overflow, which comes out above, probably carried as much water as the main channel.
[b] Gage height, 12.60.
[c] Approximate.
[d] Gage height, 10.0.
[e] Gage height, 19.0.
[f] Gage height, 16.63.
[g] Gage height 16.90.

Estimated flood discharge of streams in Milk River basin, June, 1906—Continued.

Stream.	Locality.	Location of section.	Height of high water above stream bed.	Slope of stream bed per 1,000 feet.	Flood cross section.	Estimated maximum discharge.
			Feet.	*Feet.*	*Sq. ft.*	*Sec.-ft.*
Peoples Creek	Overflow	Water from Peoples Creek above section.	.....	.....	.....	1,500
Rock Creek	Hinsdale	Just below gaging station,[a] SW. ¼ sec. 3, T. 31 N., R. 36 E.	20.00	0.75	10,100	18,000
Savoy Creek	Savoy	¾ mile north of Great Northern Rwy., NW. ¼ sec. 31, T. 32 N., R. 25 E.	11.20	1.20	560	1,800
Sixmile Coulee	Chinook	½ mile above Milk River, SW. ¼ sec. 5, T. 32 N., R. 20 E.	3.0	4.7	33	120
Snake Creek	Harlem	At Taylor's ranch, ½ mile above mouth, NE. ¼ sec. 17, T. 32 N., R. 22 E.	7.6	1.8	185	850
Taylor Coulee	Malta	50 yards above road crossing, ½ mile southwest of Malta.	3.3	13.0	70	325
Thirtymile Creek (Parallel Creek).	Harlem	3 miles northwest of Harlem, NW. ¼ sec. 34, T. 33 N., R. 22 E.	7.5	1.9	1,950	8,800
Threemile Coulee	Chinook	Near bridge, ¼ mile south of Milk River, SW. ¼ sec. 1, T. 32 N., R. 19 E.	11.5	1.90	590	1,750
Do	Harlem	At Reservation reservoir, 7 miles east of Fort Belknap Agency.	.....	.....	.....	2,000
Wayne Creek	do	Near Great Northern Rwy. bridge, 8 miles east of Harlem.	11.3	3.40	725	3,200
White Creek	Saco	At Mill's ranch, NE. ¼ sec. 3, T. 32 N., R. 33 E.	7.5	1.80	500	1,400
Whitebear Creek	Harlem	About 12 miles east of Fort Belknap Agency, and 1½ miles above Milk River.	6.5	0.70	500	1,200
Whitewater Creek.	Saco	T. 33 N., R. 32 E	.....	.....	.....	3,500
Willow Creek	Glasgow	At Cutting-Patten-Truscott reservoir.	.....	.....	.....	3,000
Yadley Coulee	Malta	1½ miles north of Malta, ¼ mile above Davidson's house.	5.2	10.0	430	2,750

[a] Gage height, 18.35.

In the following table are given various high-water marks on the Milk River and tributaries attained during 1906. In a few cases they are referred to the Great Northern track, but for most of them the elevation above sea level is given. For these elevations the Havre datum has been used; to reduce to the Malta datum subtract 0.82 foot.

Maximum heights of water in Milk River basin, June, 1906.

Stream.	Location.	Elevation of high-water marks.			Remarks.
		General.	Above sea level.	Above stream bed.	
			Feet.	*Feet.*	
Beaver Creek	NE. ¼ sec. 28, T. 29 N., R. 32 E.	.....	2,241.2	.....	
Do	Near middle of sec. 4, T. 29 N, R. 32 E.	.....	2,231.6	.....	
Do	At Ashfield post-office, SE. ¼ sec. 23, T. 31 N., R. 32 E.	.....	2,206.0	.....	
Do	Main street of Saco, Mont	.....	2,174.9	.....	
Brazil Creek	At proposed crossing of "A" line canal, station 4009, Milk River project.	.....	2,123.5	.....	
Clear Creek	200 yards south of Great Northern Rwy. at Yantic.	.....	2,444.0	9.00	
Eureka Creek	Great Northern Rwy. trestle, ½ mile east of Haro siding.	4 feet below top of rail.	.....	7.50	

Maximum heights of water in Milk River basin, June, 1906—Continued.

Stream.	Location.	Elevation of high-water marks.			Remarks.
		General.	Above sea level.	Above stream bed.	
			Feet.	*Feet.*	
Exeter Creek	Great Northern trestle, ½ mile east of Exeter siding.	4.80 feet below top of rail.	.....	8.70	
Lake Bowdoin	Along Great Northern, 4 miles east of Bowdoin siding, sec. 5, T. 30 N., R. 32 E.	5.3 feet below top of rail.	2,210.2	.....	
Lake at Wagner [a]	At Great Northern depot at Wagner.	4 feet below top of rail.	2,265.1	.....	
Milk River	Gaging station at Havre highway bridge.	.....	2,471.0	.....	Gage datum = 2,461.25.
Do	Gaging station at Malta highway bridge.	.....	2,261.0	20.00	Gage zero = 2,242.2 Havre datum.
Do	Near mouth of Buggy Creek, NW. ¼ sec. 33, T. 30 N., R. 38 E.	.....	2,106.6	.....	
Do	At court-house at Glasgow	.....	2,086.1	.....	
Milk River, North Fork.	Great Northern bridge, 7 miles east of Chinook.	9 feet below top of rail.	2,386.6	.....	
Savoy Creek	Great Northern trestle, 1½ miles east of Savoy.	2.9 feet below top of rail.	.....	8.20	
Thirtymile Creek	At Barton's store, Main street of Harlem.	.....	2,367.7	.....	Level of street 2,365.3.
Wayne Creek	At Great Northern bridge, 8 miles east of Harlem.	1.7 feet below bottom of bridge girder.	.....	11.30	

[a] Lake formed here by flood waters from coulees in this vicinity.

MUSSELSHELL RIVER DRAINAGE BASIN.

MUSSELSHELL RIVER AT SHAWMUT, MONT.

This station was established August 12, 1902, for the purpose of determining the amount of water available for irrigation and storage. It is located at Crawford's ranch, one-eighth mile from the post-office at Shawmut, Mont., and 25 miles east of Harlowtown. The gage was read during 1906 by G. T. Garner. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 87, where are given also references to publications that contain data for previous years.

Discharge measurements of Musselshell River at Shawmut, in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 23	J. H. Sloan	55	69	1.01	66
May 15	do	55	70	1.20	83
June 20	do	72	159	2.25	376
August 7	do	63	61	1.00	60
September 22 [a]	do	.....	1.6	.40	1.8
1906.					
March 30	H. M. Morse	70	131	2.28	302
May 16	G. Edson	74	129	1.95	301
July 9 [a]	Morse and Richards	38	24	.65	19.5
August 27 [a]	R. Richards	38	22	.69	27.1
November 26 [a b]	do	17	27	2.65	76

[a] Wading section. [b] River frozen.

Daily gage height, in feet, of Musselshell River at Shawmut, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.0	1.5	1.2	2.2	.....	2.2	1.1	0.5	0.7	0.75	1.75	.....
2	1.0	1.8	1.2	2.2	.....	2.1	1.1	.5	.65	.75	1.7	.....
3	1.0	1.7	1.3	2.1	.....	2.0	1.05	.4	.65	.7	1.65	2.4
4	1.0	1.5	1.4	2.1	.....	1.9	1.0	.4	.6	.7	1.7	.....
5	1.0	1.5	1.4	2.0	.....	2.1	1.0	.4	.65	.75	1.75	2.4
6	1.0	1.5	1.4	1.9	.....	2.1	1.0	.4	.6	.75	1.8	.....
7	1.0	1.4	1.4	1.8	.....	2.2	1.0	.4	.6	.75	1.8	.....
8	1.0	1.4	1.4	1.9	.....	2.2	.....	.4	.6	.8	1.8	.....
9	1.0	1.4	1.3	1.9	.....	2.3	.65	.4	.6	.8	1.85	.....
10	1.0	1.4	1.3	2.0	.....	2.0	.9	.4	.6	.8	2.0	.....
11	1.0	1.4	1.2	2.05	.....	2.2	1.0	.4	.6	.85	2.6	2.4
12	1.0	1.4	1.2	1.8	.....	2.0	.7	.4	.6	.85	2.8	.....
13	1.0	1.4	1.1	1.8	.....	1.9	.6	.4	.6	.8	2.8	.....
14	1.0	1.4	1.1	1.7	1.95	2.0	.5	.4	.75	.85	2.85	2.4
15	1.0	1.4	1.1	1.65	1.95	2.0	1.3	.4	.8	.85	2.8	.....
16	1.0	1.4	1.1	1.7	1.95	2.0	1.4	.4	.8	.85	2.9	.....
17	1.0	1.4	1.1	1.9	1.85	2.15	1.0	.4	.8	.9	3.0	.....
18	1.0	1.4	1.1	2.0	1.8	2.2	1.0	.4	.75	.9	3.0	.....
19	1.0	1.35	1.15	1.9	1.7	2.1	.9	.4	.75	.9	3.0	2.4
20	1.0	1.35	1.15	1.8	1.6	1.95	.8	.4	.7	.9	3.0	.....
21	1.0	1.3	1.2	1.8	1.6	1.8	.7	.4	.7	.95	3.0	2.5
22	1.0	1.2	1.3	1.9	1.75	1.6	.7	.4	.75	1.0	3.0	.....
23	1.0	1.2	1.3	1.9	1.75	1.55	.7	.5	.8	1.05	3.0	.....
24	1.0	1.2	1.4	1.8	1.8	1.6	.6	.5	.8	1.1	3.0	.....
25	1.0	1.0	1.4	1.9	2.0	1.7	.5	.5	.8	1.15	2.6	.....
26	1.5	1.0	1.4	1.9	2.35	1.7	.5	.....	.85	1.2	2.6	.....
27	1.5	1.0	2.0	1.8	2.45	1.6	.5	.7	.85	1.3	2.6	.....
28	1.1	1.1	.....	1.75	2.4	1.5	.5	.7	.8	1.4	2.6	2.6
29	1.2	.....	.....	1.75	2.15	1.4	.5	.7	.8	1.5	2.6	.....
30	1.2	.....	.....	1.7	2.5	1.3	.5	.7	.8	1.6	2.6	.....
31	1.4	.....	2.1	.....	2.4	.....	.5	.7	.....	1.7	.....	.....

NOTE.—Ice conditions January 1 to February 12 and March 10–20; thickness of ice, 0.5 foot, approximately. River frozen entirely across November 17 to December 31; gage heights were to water surface; thickness of ice, 0.4 foot.

Rating table for Musselshell River at Shawmut, Mont., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.40	2	1.40	122	2.40	410	3.40	880
.50	7	1.50	143	2.50	450	3.50	935
.60	15	1.60	166	2.60	490	3.60	990
.70	24	1.70	190	2.70	535	3.70	1,045
.80	34	1.80	216	2.80	580	3.80	1,100
.90	46	1.90	245	2.90	625	3.90	1,160
1.00	58	2.00	275	3.00	675	4.00	1,220
1.10	71	2.10	305	3.10	725	4.20	1,340
1.20	86	2.20	340	3.20	775	4.40	1,465
1.30	103	2.30	375	3.30	825	4.60	1,595

NOTE.—The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1905–6 and is well defined between gage heights 0.4 foot and 2.5 feet.

Monthly discharge of Musselshell River at Shawmut, Mont., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
March	245	71	113	6,950
April	103	52	81.4	4,840
May	154	46	91.5	5,630
June	1,580	166	603	35,900
July	1,330	11	139	8,550
August	410	11	52.1	3,200
September	11	2	5.7	340
October	71	4	26.7	1,640
November (1–26)	71	46	59.8	3,080
The period	.....	.....	.....	70,100

Monthly discharge of Musselshell River at Shawmut, Mont., for 1905-6.—Continued.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1906.				
February (13-24)	122	98	97.6	3,100
March (1-10; 21-27; 31)	305	86	129	4,610
April	340	178	242	14,400
May (14-31)	450	166	281	10,000
June	375	103	254	15,100
July	122	7	38.8	2,390
August	24	2	6.7	418
September	40	15	25.5	1,520
The period				51,500

NOTE.—Values are rated as follows: March to May and July, 1905, excellent; June, August, October, and November, 1905, July and September, 1906, good; September, 1905, April to June and August, 1906, fair; February and March, 1906, approximate.

MUSSELSHELL RIVER AT LAVINA, MONT.

This station was established June 7, and was discontinued July 27, 1906. It is located at the highway bridge in the southern part of the town of Lavina.

The channel is straight for 180 feet above the bridge, but curves below, commencing at the bridge. The right bank is low and subject to overflow; the left is high and not subject to overflow. The bed of the stream is of mud and may shift somewhat.

Discharge measurements were made from the upstream side of the bridge.

The chain gage is fastened to the upstream side of the bridge. The observer was W. J. Phillips. The bench mark is a cross drilled in the concrete of the north side of the east abutment; elevation, 14.60 feet above the gage datum.

Discharge measurements of Musselshell River at Lavina, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 29	Morse and Sloan	85	281	4.08	888
June 6	Morse and Whinery	87	261	3.73	725
June 7	A. H. Whinery	86	221	3.26	519

Daily gage height, in feet, of Musselshell River at Lavina, Mont., for 1906.

Day.	June.	July.	Day.	June.	July.
1		2.20	16	2.70	2.22
2		2.12	17	2.80	2.18
3		2.08	18	2.78	2.08
4		2.00	19	2.78	1.92
5		1.90	20	2.65	1.82
6		1.90	21	2.52	1.75
7	3.10	1.88	22	2.48	1.62
8	2.90	1.85	23	2.52	1.58
9	2.82	1.80	24	2.32	1.48
10	2.72	1.78	25	2.42	1.40
11	2.68	1.72	26	2.52	1.32
12	2.80	1.70	27	2.62	1.22
13	2.72	2.10	28	2.52	
14	2.62	2.22	29	2.42	
15	2.62	1.95	30	2.28	

LITTLE MUDDY RIVER DRAINAGE BASIN.

LITTLE MUDDY RIVER NEAR WILLISTON, N. DAK.

This station was established February 4, 1904. It is located in sec. 19, T. 155 N., R 100 W., the gage in the southwest quarter and the cable in the northeast quarter, about 7 miles by road from Williston, N. Dak. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 89, where are given also references to publications that contain data for previous years. The length of the chain is now 22.44 feet. The data collected at this station are valuable for irrigation purposes.

Discharge measurements of Little Muddy River near Williston, N. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 22	E. F. Chandler	8	8.8	2.66	16.4
April 22	do	8	7.7	2.66	[a] 18.2
May 28	do	30	17.8	2.92	30.2
September 4	do	8	7.6	2.45	8.8

[a] Float measurement.

Daily gage height, in feet, of Little Muddy River near Williston, N. Dak., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	2.5			3.75	2.85	3.1	2.9	2.5	2.5	2.5	2.5
2				4.0	2.9	3.1	2.8	2.5	2.4	2.5	2.5
3				4.25	2.9	3.0	2.8	2.6	2.5	2.5	2.5
4		2.5		4.2	2.9	2.9	2.7	2.4	2.4	2.5	2.5
5			2.5	3.8	2.85	3.0	2.8	2.5	2.4	2.5	2.5
6				3.45	2.75	3.15	2.7	2.4	2.4	2.5	2.5
7				3.15	2.7	5.7	2.8	2.5	2.4	2.5	2.5
8	2.5			3.05	2.7	5.6	2.7	2.4	2.4	2.5	2.5
9				3.0	2.7	5.5	2.8	2.5	2.4	2.5	2.5
10				2.9	2.7	5.05	2.7	2.4	2.4	2.5	2.5
11		2.5		2.9	2.7	4.45	2.8	2.5	2.4	2.5	2.5
12				2.95	2.7	4.0	2.6	2.4	2.4	2.5	2.5
13				3.0	2.7	3.85	2.7	2.5	2.5	2.5	2.5
14				3.0	2.7	3.65	2.6	2.4	2.5	2.5	2.5
15	2.5		2.4	2.9	2.7	3.3	2.7	2.5	2.5	2.5	2.6
16				2.9	2.7	3.15	2.6	2.4	2.5	2.5	2.6
17				2.9	2.7	3.1	2.7	2.5	2.5	2.5	2.6
18				2.9	2.7	3.1	2.6	2.4	2.5	2.5	2.6
19		2.5		2.9	2.7	3.05	2.7	2.5	2.5	2.5	2.6
20			2.4	2.8	2.7	3.0	2.5	2.4	2.5	2.5	2.6
21				2.7	2.7	3.0	2.6	2.5	2.5	2.5	2.6
22	2.5			2.7	2.7	2.9	2.5	2.4	2.5	2.5	2.6
23				2.7	2.7	2.9	2.6	2.5	2.5	2.5	2.6
24				2.7	2.7	2.9	2.5	2.4	2.5	2.5	
25				2.7	2.8	2.9	2.6	2.5	2.5	2.5	
26				2.7	2.8	2.9	2.5	2.4	2.5	2.5	
27			2.8	2.7	2.85	2.9	2.6	2.5	2.5	2.5	
28		2.5	2.9	2.7	2.9	2.9	2.5	2.4	2.5	2.5	
29			2.9	2.7	2.95	2.9	2.5	2.5	2.5	2.5	
30			3.0	2.7	3.0	2.9	2.4	2.4	2.5	2.5	
31	2.5		3.1		3.1		2.5	2.5		2.5	

NOTE.—Ice conditions January 1 to March 26; also November 24 to December 31. Ice increased in thickness from 1.3 feet January 1 to 1.8 feet February 1 and decreased to 0.3 foot from February 28 to March 20. Thickness of ice during December was 0.3 to 1.2 feet.

Rating table for Little Muddy River near Williston, N. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.40	6	3.30	104	4.20	391	5.10	753
2.50	9	3.40	131	4.30	428	5.20	796
2.60	14	3.50	160	4.40	466	5.30	839
2.70	20	3.60	190	4.50	505	5.40	882
2.80	27	3.70	221	4.60	545	5.50	925
2.90	35	3.80	253	4.70	585	5.60	968
3.00	45	3.90	286	4.80	626	5.70	1,011
3.10	60	4.00	320	4.90	668		
3.20	80	4.10	355	5.00	710		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904-1906 and is fairly well defined.

Monthly discharge of Little Muddy River near Williston, N. Dak., for 1906.

[Drainage area, 800 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March 27-31	60	27	40.4	401	0.050	0.01
April	409	20	84.1	5,000	.105	.12
May	60	20	26.3	1,620	.033	.04
June	1,010	35	199	11,800	.249	.28
July	35	6	17.4	1,070	.022	.03
August	14	6	7.8	480	.0098	.01
September	9	6	8.0	476	.010	.01
October	9	9	9.0	553	.011	.01
November 1-23	14	9	11.0	502	.014	.01
The period				21,900		

NOTE.—Values are fair.

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous measurements of Little Muddy River were made in 1905:

Miscellaneous discharge measurements of Little Muddy River, in 1905.

Date.	Locality.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
March 1	Williston		40
March 2	do		70
March 27	do		22
June 7	8 miles above Williston	1.90	48

YELLOWSTONE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The upper Yellowstone rises in the Shoshone Mountains, in northwestern Wyoming, near the southeast corner of the Yellowstone National Park, flows northwestward for 40 or 50 miles, and then enters Yellowstone Lake, which may be considered the great source of the main river. This lake is about 15 miles long by 20 miles wide,

lies at an elevation of 7,778 feet above the sea, and is hemmed in on every side by lofty mountains from whose snow-covered slopes its chief supply of water must come, since it receives no important streams. Issuing from the lake at the north end, the stream flows northwestward for 10 or 15 miles, plunges over the Great Falls of the Yellowstone, and for the next 20 miles runs through the Grand Canyon, which is impassable throughout. About 80 miles from the lake it emerges from the Snow Mountains, and thence runs eastward and northeastward until it joins the Missouri at Fort Buford, N. Dak. The length of the Yellowstone is about 500 miles; the area of the basin is approximately 67,500 square miles.

Of the tributaries of the Yellowstone the most important is the Bighorn, which has its source in the many small streams draining the intersecting slopes of the Wind River and Shoshone Mountains in northwestern Wyoming, about 30 miles southeast of Yellowstone National Park. For approximately 75 miles it flows southeastward, its volume being constantly augmented by small streams from the south heading well back in the Wind River Range, but receiving no important additions from the north. In this portion of its course it is called Wind River, but at its southernmost point it is joined by Little Wind River, turns abruptly to the northeast, and is below known as the Bighorn. Continuing in a winding course for about 15 miles, it then turns directly north, passes through a deep canyon in the Owl Creek Range, crosses Bighorn County, Wyo., into Montana, and joins the Yellowstone about 30 miles north of Fort Custer.

The principal tributaries of the Bighorn are Wind, Little Wind, and Popo Agie rivers, which combined carry the great perennial discharge and become the headwaters; Muskrat, Poison, and Badwater creeks, which enter below the mouth of the Little Wind and drain the sand hills to the east; Muddy Creek, which follows the foothills of the Owl Creek Range; Gooseberry Creek, Gray Bull Creek, No Wood Creek, and Shoshone and Little Bighorn rivers.

The Shoshone rises on the eastern slope of the Shoshone Mountains, east of the Yellowstone National Park. It has two chief upper branches, North and South forks, which unite just before entering Shoshone Canyon, at a point about 12 miles southwest of Cody. From the junction of the forks the course of the main river is a little east of northeast to the Bighorn.

The data collected in the basin are valuable for irrigation purposes.

YELLOWSTONE RIVER AT JUNCTION, MONT.

This station was established May 10, 1906, to take the place of the one at Billings. It is located at the county highway bridge at Junction, and 1 mile north of Custer, Mont. It is about 3 miles above the mouth of Bighorn River.

The channel is straight for 1,500 feet above and 2,400 feet below the gage. The right bank is rather low and may overflow at very high stages; the left is high and will not overflow. The bed of the stream is partly bowlders and gravel, but for the most part consists of clay and sand. There is but one channel at all stages, broken by the two bridge piers. The current is moderately swift.

Discharge measurements are made from the downstream side of the bridge, which consists of three spans. The initial point for soundings is directly over the center of the northeast pile of the north abutment.

A standard chain gage, which is read daily by J. E. Thurmond, is attached to the floor of the bridge on the upstream side in the north span; length of chain, 29.65 feet. The bench mark is a rivet in the northwest pile abutment on the north side of the river, painted "U.S.G.S."; elevation, 23.33 feet above the gage zero.

Discharge measurements of Yellowstone River at Junction, Mont., in 1906.

Date.	Hydrographer.	Area of section.	Gage height.	Discharge.
		Sq. ft.	*Feet.*	*Sec.-ft.*
May 10	H. M. Morse	2,300	3.88	5,190
July 2	R. H. Whinery	3,420	5.51	14,800
August 7	R. Richards	2,900	4.62	9,080
September 5	Follansbee and Richards	2,410	3.97	5,330
September 15	Grover and Follansbee	2,290	3.87	4,390
October 11	Follansbee and Richards	2,120	3.50	3,270
November 6	R. Richards	2,070	3.42	2,930

Daily gage height, in feet, of Yellowstone River at Junction, Mont., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct	Nov.	Dec.
1		5.75	5.4	4.4	4.0	3.6	3.45	3.5
2		5.55	5.6	4.3	4.0	3.55	3.45	3.4
3		5.5	6.0	4.3	4.0	3.5	3.45	3.35
4		5.45	5.8	4.4	3.95	3.5	3.4	3.45
5		5.4	5.9	4.4	3.95	3.5	3.4	3.45
6		6.3	6.0	4.35	3.95	3.5	3.4	3.4
7		6.5	6.1	4.4	3.85	3.5	3.4	3.5
8		5.9	6.15	4.5	3.85	3.5	3.4	3.4
9		5.7	5.95	4.5	3.8	3.45	3.4	3.3
10	3.9	5.6	5.9	4.4	3.75	3.45	3.4	3.2
11	4.3	5.7	5.9	4.3	3.75	3.45	3.45	3.2
12	5.0	5.9	5.85	4.2	3.8	3.4	3.4	3.4
13	5.4	6.95	5.85	4.1	3.8	3.4	3.4	3.35
14	6.45	8.8	5.9	4.05	3.8	3.4	3.4	3.5
15	6.45	8.2	5.85	4.0	3.85	3.4	3.4	3.2
16	6.1	7.6	5.8	4.1	3.85	3.4	3.4	3.1
17	5.7	7.4	5.7	4.1	3.8	3.45	3.4	3.2
18	5.25	7.4	5.55	4.1	3.8	3.5	3.5	3.3
19	4.95	6.7	5.6	4.05	3.7	3.5	3.35	3.35
20	4.7	6.2	5.4	4.0	3.6	3.5	3.15	3.45
21	4.9	5.95	5.2	4.0	3.75	3.5	3.15	3.4
22	5.45	5.7	5.1	4.2	3.75	3.5	3.15	3.4
23	5.85	5.55	5.05	4.3	3.75	3.5	3.2	3.45
24	5.75	5.7	5.0	4.5	3.7	3.45	3.2	3.2
25	6.65	5.55	4.9	5.0	3.7	3.4	3.2	[illegible]
26	6.5	5.4	4.85	4.6	3.7	3.45	3.2	3.45
27	6.5	5.5	4.7	4.5	3.7	3.45	3.45	[illegible]
28	6.4	5.6	4.6	4.35	3.65	3.45	3.4	3.45
29	6.3	5.5	4.55	4.2	3.65	3.45	3.4	3.5
30	6.3	5.5	4.5	4.15	3.65	3.45	3.4	3.45
31	6.15	.....	4.5	4.1	.....	3.45	.....	3.4

NOTE.—Practically open-channel conditions during December.

Rating table for Yellowstone River at Junction, Mont., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.10	1,950	4.40	7,670	5.70	16,150	7.00	26,900
3.20	2,240	4.50	8,250	5.80	16,890	7.20	28,740
3.30	2,550	4.60	8,830	5.90	17,650	7.40	30,640
3.40	2,900	4.70	9,430	6.00	18,410	7.60	32,580
3.50	3,250	4.80	10,030	6.10	19,190	7.80	34,560
3.60	3,640	4.90	10,650	6.20	19,990	8.00	36,600
3.70	4,070	5.00	11,290	6.30	20,810	8.20	38,680
3.80	4,530	5.10	11,950	6.40	21,650	8.40	40,820
3.90	5,010	5.20	12,630	6.50	22,500	8.60	43,000
4.00	5,510	5.30	13,310	6.60	23,360	8.80	45,200
4.10	6,030	5.40	14,010	6.70	24,220		
4.20	6,570	5.50	14,710	6.80	25,100		
4.30	7,110	5.60	15,430	6.90	26,000		

NOTE.—The above table is applicable only for open-channels conditions. It is based on seven discharge measurements made during 1906 and is well defined between gage heights 3.4 feet and 6.0 feet.

Monthly discharge of Yellowstone River at Junction, Mont., for 1906.

[Drainage area, 13,500 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
May (10–31)	23,800	5,010	16,400	716,000	1.21	0.99
June	45,200	14,000	20,100	1,200,000	1.49	1.66
July	19,600	8,250	14,600	898,000	1.08	1.24
August	11,300	5,510	7,060	434,000	.523	.60
September	5,510	3,640	4,520	269,000	.335	.37
October	3,640	2,900	3,140	193,000	.233	.27
November	3,250	2,100	2,770	165,000	.205	.23
December	3,250	1,950	2,810	173,000	.208	.24
The period				4,050,000		

NOTE.—Values for 1906 are excellent.

YELLOWSTONE RIVER AT GLENDIVE, MONT.

This station, established in 1893 by the United States War Department, was transferred to the Department of Agriculture, which has kept daily records of river height. When a study of the lower Yellowstone Valley was begun in 1903 this station was taken up by the United States Geological Survey, whose records begin August 1, 1903. The station is located at the steel highway bridge leading northward from Glendive, about one-fourth mile from the post-office. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 97, where are given also references to publications that contain data for previous years.

Discharge measurements of Yellowstone River at Glendive, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 11	H. M. Morse	737	3,750	2.88	10,000
July 9	R. H. Whinery	752	5,920	6.08	30,600
August 4	R. Richards	742	4,340	3.72	15,700
September 6	Follansbee and Richards	735	3,690	2.84	10,900
September 13	Grover and Follansbee	729	3,220	2.40	8,260
October 13	R. Richards	715	2,540	1.39	5,610
November 5	do	711	2,480	1.36	4,990

Daily gage height in feet, of Yellowstone River at Glendive, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.6	2.8	4.8	4.6	3.35	7.55	5.45	3.9	3.7	1.65	1.35
2	1.7	2.8	4.6	.....	3.1	7.1	5.4	3.75	3.5	1.6	1.35
3	1.6	2.9	4.4	4.15	2.9	6.55	5.1	3.65	3.25	1.45	1.35
4	1.5	4.2	4.2	4.0	2.7	6.05	5.45	3.95	3.05	1.45	1.35
5	1.4	4.2	3.9	3.7	2.4	5.75	5.8	4.2	2.95	1.45	1.35
6	1.7	4.2	3.9	3.4	2.5	5.8	5.9	4.15	2.8	1.4	1.3
7	1.8	4.0	3.9	3.1	2.75	8.4	5.95	4.0	2.7	1.35	1.3
8	1.8	3.6	4.1	.....	3.0	10.1	6.0	4.0	2.6	1.35	1.3
9	.....	3.1	4.5	2.6	3.0	9.25	6.05	4.0	2.5	1.35	1.3
10	.....	2.9	4.3	2.5	2.9	7.85	6.0	4.35	2.4	1.35	1.3
11	.....	2.9	4.3	2.5	2.9	6.55	5.95	4.0	2.25	1.35	1.4
12	2.2	3.1	4.1	2.55	2.9	5.95	5.95	3.6	2.3	1.35	1.3
13	2.2	3.3	4.1	2.55	3.3	5.95	5.85	3.45	2.4	1.35	1.3
14	2.2	3.1	3.2	2.55	4.4	7.9	6.0	3.25	2.6	1.35	1.3
15	2.3	3.2	2.7	2.45	5.4	8.5	5.85	3.05	2.5	1.25	1.3
16	2.2	3.2	2.2	2.35	6.75	9.3	6.1	2.9	2.4	1.25	1.3
17	2.2	3.3	2.2	2.25	6.9	9.0	6.35	3.0	2.35	1.25	1.3
18	2.1	3.4	2.0	2.1	6.55	8.55	6.2	2.85	2.5	1.25	1.3
19	2.1	3.4	2.2	1.95	6.0	8.5	5.9	2.7	2.5	1.25	.....
20	2.1	3.6	1.95	1.95	5.45	8.1	5.7	2.5	2.4	1.25	.....
21	2.1	3.7	2.2	2.1	5.05	7.3	5.7	2.55	2.3	1.25	.....
22	2.2	4.4	2.45	2.2	4.75	6.85	5.45	2.55	2.2	1.25	.....
23	2.3	4.5	3.05	2.25	5.15	6.25	5.2	3.3	2.2	1.25	.....
24	2.1	4.3	3.45	2.25	5.9	5.85	5.0	4.15	2.15	1.3	.....
25	2.0	4.3	3.75	.....	7.1	5.8	4.9	4.9	2.05	1.3	.....
26	2.0	4.2	3.95	2.9	7.8	5.55	4.8	5.85	1.95	1.25	.....
27	2.2	4.8	4.0	3.5	8.35	5.4	4.7	5.8	1.9	1.25	.....
28	2.3	4.8	6.7	3.6	8.25	5.2	4.7	5.25	1.8	1.25	.....
29	2.5	.....	8.5	3.6	8.15	5.35	4.5	4.8	1.75	1.3	.....
30	2.5	.....	6.75	3.6	7.8	5.6	4.3	4.35	1.7	1.35	.....
31	2.7	.....	5.55	.....	7.6	.....	4.1	4.0	.....	1.35	.....

NOTE.—Ice conditions Jan. 1-Mar. 29; gage readings were to top of ice after Jan. 25. Ice conditions Nov. 19-Dec. 31.

Rating table for Yellowstone River at Glendive, Mont., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	5,300	2.60	9,180	4.00	15,400	5.80	27,500
1.30	5,530	2.70	9,540	4.10	15,950	6.00	29,200
1.40	5,760	2.80	9,920	4.20	16,500	6.20	31,000
1.50	5,990	2.90	10,300	4.30	17,050	6.40	32,900
1.60	6,240	3.00	10,700	4.40	17,650	6.60	34,900
1.70	6,490	3.10	11,120	4.50	18,250	6.80	37,000
1.80	6,740	3.20	11,540	4.60	18,850	7.00	39,200
1.90	7,020	3.30	11,980	4.70	19,500	7.20	41,400
2.00	7,300	3.40	12,440	4.80	20,150	7.40	43,700
2.10	7,580	3.50	12,900	4.90	20,800	7.60	46,100
2.20	7,860	3.60	13,380	5.00	21,500	7.80	48,500
2.30	8,160	3.70	13,860	5.20	22,900	8.00	50,900
2.40	8,480	3.80	14,360	5.40	24,300	9.00	64,000
2.50	8,820	3.90	14,880	5.60	25,900	10.00	78,000

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904, and is well defined between gage heights 1.3 feet and 8 feet. Below 2.4 feet the table is the same as for 1905.

Monthly discharge of Yellowstone River at Glendive, Mont., for 1906.

[Drainage area, 66,100 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	18,800	7,160	10,700	637,000	0.162	0.18
May	55,400	8,480	25,100	1,540,000	.380	.44
June	79,400	22,900	41,500	2,470,000	.628	.70
July	32,400	16,000	26,300	1,620,000	.398	.46
August	27,900	8,820	15,400	947,000	.233	.27
September	13,900	6,490	8,820	525,000	.133	.15
October	6,360	5,420	5,610	345,000	.085	.10
November			5,570	331,000	.084	.09
The period				8,420,000		

NOTE.—No estimates for ice period. Values are rated as follows: April to June, excellent; July to November, good.

CLARK FORK AT FROMBERG, MONT.

The gaging station was established June 3, 1905. It is located on the highway bridge one-half mile east of the Northern Pacific Railway station at Fromberg, Mont. One small stream, Rock Creek, flows into the river between the gaging station and its mouth. The gage was read during 1906 by Mrs. E. V. Moran. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 100.

Discharge measurements of Clark Fork at Fromberg, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 12	H. M. Morse	190	637	5.57	2,530
June 2	Morse and Whinery	168	534	5.17	1,930
June 15	R. H. Whinery	209	1,010	7.32	5,950
June 26	do	170	493	5.00	1,750
July 28	Richards and Whinery	165	479	4.62	1,450
September 4	R. Richards	130	348	3.90	696

Daily gage height, in feet, of Clark Fork at Fromberg, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.4	3.45	3.35	3.5	4.0	5.4	5.4	4.2	4.0	3.5	3.35	3.5
2	3.4	3.4	3.35	3.6	3.7	5.1	5.75	4.1	4.0	3.45	3.35	3.5
3	3.4	3.4	3.35	3.5	4.1	5.2	5.95	4.2	3.9	3.45	3.3	3.5
4	3.4	3.5	3.35	3.4	4.2	5.2	6.0	4.2	3.9	3.5	3.3	3.5
5	3.4	3.5	3.2	3.5	4.35	4.8	6.1	4.25	3.8	3.45	3.3	3.5
6	3.4	3.5	3.35	3.45	4.3	5.8	6.25	4.45	3.8	3.45	3.35	3.5
7	3.4	3.6	3.35	3.6	4.1	5.55	6.1	4.3	3.75	3.55	3.35	3.5
8	3.4	3.6	3.35	3.6	3.9	5.45	6.1	4.2	3.6	3.45	3.35	3.5
9	3.4	4.3	3.3	3.6	3.9	5.5	6.1	4.2	3.5	3.35	3.4	3.5
10	3.4	3.6	3.3	3.7	4.45	5.6	5.95	4.25	3.5	3.35	3.4	3.5
11	3.4	3.6	3.3	3.6	5.05	6.0	6.05	4.2	3.5	3.35	3.45	3.7
12	3.4	3.6	3.3	3.6	5.45	6.5	6.15	4.1	3.4	3.35	3.45	3.6
13	3.4	3.6	.....	3.5	5.65	7.9	6.25	4.0	3.5	3.4	3.45	3.6
14	3.4	3.6	.....	3.6	6.17	7.95	6.05	4.1	3.6	3.4	3.4	3.6
15	3.5	3.6	.....	3.6	5.85	7.45	5.85	4.0	3.7	3.35	3.4	3.6

Daily gage height, in feet, of Clark Fork at Fromberg, Mont., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	3.5	3.55	.....	3.7	5.57	6.95	5.45	4.0	3.7	3.35	3.4	3.6
17	3.5	3.48	3.3	3.6	5.4	6.7	5.25	3.9	3.7	3.3	3.4	3.6
18	3.5	3.45	3.3	3.7	4.97	6.2	5.35	3.9	3.6	3.3	3.35	3.6
19	3.5	3.4	.....	3.7	4.8	5.8	5.45	3.9	3.6	3.3	3.35	3.6
20	3.5	3.4	.....	3.75	4.75	5.35	5.35	4.02	3.55	3.25	3.35	3.6
21	3.5	3.35	.....	3.82	5.27	5.2	5.25	5.25	3.5	3.25	3.35	3.6
22	3.5	3.35	.....	4.1	5.5	5.3	4.95	4.5	3.5	3.25	3.45	3.6
23	3.5	3.35	.....	4.55	5.7	5.2	4.9	5.8	3.5	3.25	3.45	3.55
24	3.45	3.35	4.05	4.4	6.05	5.1	5.0	6.0	3.5	3.3	3.45	3.55
25	3.45	3.35	4.0	4.22	5.8	5.0	4.85	5.8	3.5	3.3	3.45	3.55
26	3.45	3.35	3.2	4.1	6.1	5.2	4.85	4.8	3.7	3.35	3.4	3.55
27	3.45	3.35	3.8	4.0	5.8	5.2	4.65	4.25	3.7	3.35	3.4	3.5
28	3.45	3.34	3.6	4.0	5.8	5.3	4.6	4.25	3.6	3.35	3.35	3.5
29	3.45	.....	3.6	4.1	5.6	5.3	4.3	4.15	3.6	3.4	3.5	3.5
30	3.45	.....	3.55	4.0	5.7	5.3	4.4	4.2	3.5	3.35	3.5	3.5
31	3.45	.....	3.6	.....	5.6	.....	4.25	4.0	.....	3.35	.....	3.5

NOTE.—Ice conditions January 1 to 31; February to March 28; readings to top of ice except occasionally when water overflowed ice. Ice conditions December 13–22; readings to top of ice.

Rating table for Clark Fork at Fromberg, Mont., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.20	250	4.20	908	5.20	1,973	6.20	3,475
3.30	296	4.30	999	5.30	2,102	6.40	3,850
3.40	346	4.40	1,094	5.40	2,236	6.60	4,260
3.50	400	4.50	1,192	5.50	2,375	6.80	4,690
3.60	458	4.60	1,293	5.60	2,519	7.00	5,140
3.70	520	4.70	1,397	5.70	2,667	7.20	5,600
3.80	587	4.80	1,504	5.80	2,819	7.40	6,080
3.90	660	4.90	1,615	5.90	2,975	7.60	6,570
4.00	738	5.00	1,730	6.00	3,135	7.80	7,070
4.10	821	5.10	1,849				

NOTE.—The above table is applicable only for open-channel conditions. It is based on ten discharge measurements made during 1905 and 1906, and is well defined between gage heights 3.5 feet and 7.5 feet.

Monthly discharge of Clark Fork at Fromberg, Mont., for 1906.

[Drainage area, 2,500 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	1,240	346	587	34,900	0.235	0.26
May	3,420	520	1,950	120,000	.780	.90
June	7,440	1,500	2,930	174,000	1.17	1.30
July	3,570	954	2,390	147,000	.956	1.10
August	3,140	660	1,120	68,900	.448	.52
September	738	346	488	29,000	.195	.22
October	400	273	330	20,300	.132	.15
November	400	296	343	20,400	.137	.15
December	.....	.....	*a* 400	24,600	.160	.18
The period	.....	.....	.....	639,000	.....	.....

a Flow estimated during ice period in December.

NOTE.—Values are rated as follows: April to November, excellent; December, fair.

PRYOR CREEK AT HUNTLEY, MONT.

The station was originally established August 6, 1904, and measurements were made at different sections. Pryor Creek was turned into a new channel June 15–16, 1906, by the Reclamation Service and a station was established on the steel highway bridge crossing this channel one-half mile from the railroad station at Huntley.

The channel is straight, with uniform slope for 800 feet above and below station. The banks are steep and uniformly graded. They are clean and will not overflow. The current is moderate. The bed is composed of clay and gravel and may change somewhat.

Discharge measurements are made from the highway bridge. The initial point for soundings is the center of the right abutment, lower side.

The standard chain gage, which is read twice daily by employees of the Reclamation Service, is attached to the floor of the bridge; length of chain, 16.23 feet. The bench mark is a U. S. G. S. standard bench mark, set in the concrete abutment of the bridge, on the left bank, upstream side; elevation, 14.67 feet above the gage datum.

Discharge measurements of Pryor Creek at Huntley, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 27	Morse and Sloan	25	82	6.27	410
March 27	do	25	82	6.27	387
April 12	J. H. Sloan	17	27	3.00	87.5
June 5	Morse and Whinery	16	19	2.22	45.3
July 3	Morse and Richards	29	14	1.13	20.3
August 8	W. S. Hartman	30	13	1.04	14.2
August 24	R. H. Whinery	35	67	3.00	219
October 5	Robert Follansbee	31	18	1.18	22.5
October 10	Follansbee and Richards	29	15	1.16	20.6

NOTE.—Beginning July 3 the gage heights refer to the gage at the new station.

Daily gage height, in feet, of Pryor Creek at Huntley, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	2.4	3.1	3.1	2.55	2.3	2.65	1.0	1.0	1.1	1.0	1.2
2	2.4	3.25	2.9	3.35	2.25	2.45	1.0	1.0	1.1	1.15	1.2
3	2.4	3.3	2.75	.....	2.1	2.45	1.0	1.1	1.1	1.15	1.2
4	2.4	3.3	2.7	3.35	2.25	2.25	0.9	1.1	1.1	1.2	1.2
5	2.4	3.45	2.5	3.9	2.15	2.25	0.9	1.05	1.1	1.2	1.2
6	2.4	3.5	2.75	5.7	2.2	2.05	0.9	1.05	1.1	1.2	1.2
7	2.4	3.4	3.6	5.2	2.15	2.65	1.0	1.05	1.1	1.2	1.15
8	2.4	3.4	4.0	5.05	2.15	2.5	1.0	1.0	1.1	1.2	1.2
9	2.4	3.4	4.3	3.85	2.15	2.2	1.0	1.0	1.1	1.2	1.2
10	2.5	3.4	.....	2.85	2.15	2.4	1.0	1.0	1.1	1.2	1.2
11	2.5	3.4	.....	2.55	2.05	2.1	1.0	1.0	1.1	1.2	1.2
12	2.5	3.3	.....	2.85	2.05	2.05	1.0	1.0	1.15	1.2	1.2
13	2.5	3.3	.....	3.1	2.45	1.85	1.0	1.0	1.25	1.2	1.2
14	2.5	3.3	.....	2.5	2.8	1.8	1.0	1.0	1.2	1.15	1.2
15	2.5	3.85	.....	2.4	2.45	1.0	1.0	1.0	1.2	1.15	1.25
16	2.5	4.85	2.9	2.35	2.2	1.0	1.1	1.0	1.2	1.15	1.3
17	2.5	6.0	3.5	2.3	2.1	1.0	1.1	1.0	1.2	1.2	1.3
18	2.5	8.25	3.55	2.35	2.05	1.0	1.0	1.0	1.15	1.2	1.5
19	2.5	6.9	3.65	2.35	2.05	1.2	1.0	1.0	1.1	1.2	1.5
20	2.5	6.8	3.55	2.35	2.0	1.3	1.0	0.95	1.1	1.2	1.5

Daily gage height, in feet, of Pryor Creek at Huntley, Mont., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
21	2.5	4.7	3.3	2.35	1.95	1.5	1.0	1.0	1.1	1.2	1.5
22	2.5	4.6	3.25	2.35	1.95	1.4	1.0	1.1	1.1	1.2	1.6
23	2.5	3.7	4.5	2.45	2.05	1.3	1.0	3.1	1.1	1.2	1.6
24	2.5	3.75	7.0	2.65	2.65	1.2	0.9	2.9	1.1	1.2	1.6
25	2.5	3.2	.....	2.75	5.05	1.1	0.9	1.75	1.1	1.2	1.6
26	2.5	3.55	.....	2.75	3.5	1.1	0.9	1.4	1.1	1.2	1.6
27	2.5	3.0	6.4	2.6	3.0	1.1	0.9	1.2	1.1	1.2	.....
28	2.9	3.0	4.65	2.55	3.55	1.2	0.9	1.2	1.1	1.2	.....
29	2.65	.....	3.45	2.45	5.4	1.2	0.9	1.1	1.1	1.2	.....
30	2.75	.....	2.95	2.35	5.1	1.3	0.9	1.1	1.1	1.2	.....
31	3.4	.....	2.65	.....	3.05	.....	1.0	1.1	.....	1.2	.....

NOTE.—Ice conditions January 1 to March 28; readings to ice surface. The channel was changed June 15-16. Ice conditions November 18 to December 31.

Rating tables for Pryor Creek at Huntley, Mont.

MARCH 27, 1906, TO JUNE 14, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.80	28	2.80	77	3.80	148	4.80	240
1.90	32	2.90	83	3.90	156	4.90	250
2.00	36	3.00	89	4.00	164	5.00	260
2.10	40	3.10	96	4.10	173	5.20	282
2.20	45	3.20	103	4.20	182	5.40	304
2.30	50	3.30	110	4.30	191	5.60	327
2.40	55	3.40	117	4.40	200	5.80	351
2.50	60	3.50	124	4.50	210	6.00	375
2.60	65	3.60	132	4.60	220	6.20	400
2.70	71	3.70	140	4.70	230	6.40	426

JUNE 15, 1906, TO NOVEMBER 26, 1906.[b]

0.90	6	1.50	47	2.10	104	2.60	164
1.00	11	1.60	55	2.20	115	2.70	177
1.10	17	1.70	64	2.30	127	2.80	190
1.20	24	1.80	73	2.40	139	2.90	204
1.30	31	1.90	83	2.50	151	3.00	218
1.40	39	2.00	93				

[a] This table is applicable only for open-channel conditions. It is based on four discharge measurements made during the spring of 1906 and is not very well defined. After June 14 the following rating is necessary on account of change in channel:

[b] This table is applicable only for open-channel conditions. It is based on five discharge measurements made during the latter part of 1906 and is not well defined.

Monthly discharge of Pryor Creek at Huntley, Mont., for 1906.

[Drainage area, 800 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	339	50	96.8	5,760	0.121	0.14
May	304	34	75.9	4,670	.095	1.10
June	68	11	35.0	2,080	.044	.05
July	17	6	9.8	603	.012	.01
August	237	8	29.5	1,810	.037	.04
September	28	17	18.6	1,110	.023	.03
October	24	11	22.8	1,400	.028	.03
November	.....	.....	[a] 24.0	1,430	.030	.03
The period	.....	.....	.....	18,900	.....	.....

[a] Latter part of month estimated.

NOTE.—No estimate for ice period. Values for 1906 are good.

BIGHORN RIVER AT FORT CUSTER, MONT.

This station was established June 16, 1904. It is located at the bridge of the Burlington and Missouri River Railroad, about one-half mile above the junction of Bighorn and Little Bighorn rivers, near the station at Fort Custer. During 1906 gage was read by W. O. Henshaw. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 108, where are given also references to publications that contain data for previous years. The gage heights for 1906 are referred to a datum that is 2 feet lower than that used in 1905.

Discharge measurements of Bighorn River at Fort Custer, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 5	J. H. Sloan	429	1,720	3.61	4,010
May 14	do	438	3,030	6.18	17,400
June 20	R. H. Whinery	439	3,270	6.75	17,100
July 31	Richards and Whinery	433	2,100	4.52	6,420
September 3	Follansbee and Richards	431	1,840	3.87	4,480
September 14	Grover and Follansbee	428	1,540	3.52	2,840
October 12	Robert Follansbee	426	1,370	3.09	1,740
November 7	R. Richards	424	1,360	2.96	1,580

Daily gage height, in feet, of Bighorn River at Fort Custer, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	3.22	3.90	4.10	4.25	3.60	6.02	5.02	4.40	4.05	3.12	3.00
2	3.22	3.90	4.10	4.08	3.48	5.58	5.30	4.25	3.95	3.12	3.00
3	3.27	3.82	4.07	3.95	3.45	5.25	5.62	4.32	3.88	3.12	2.95
4	3.35	3.75	4.12	3.85	3.50	5.18	5.68	4.18	3.82	3.10	2.95
5	3.30	3.55	4.10	3.68	3.48	5.25	5.82	4.12	3.70	3.08	2.95
6	3.35	3.62	4.07	3.45	3.58	5.42	5.98	4.18	3.72	3.08	2.95
7	3.35	3.70	3.92	3.32	3.62	5.90	5.98	4.55	3.68	3.08	2.95
8	3.40	3.70	3.75	3.30	3.58	5.85	5.85	4.98	3.62	3.08	2.95
9	3.45	3.75	3.15	3.35	3.60	5.70	5.80	4.58	3.55	3.08	3.00
10	3.52	3.77	3.40	3.38	3.75	5.28	5.92	4.48	3.52	3.08	3.00
11	3.55	3.77	3.40	3.48	4.05	5.28	5.90	4.28	3.50	3.08	3.00
12	3.55	3.82	3.47	3.48	4.42	5.92	5.90	4.12	3.52	3.08	3.00
13	3.55	3.80	3.12	3.48	4.88	6.50	5.90	4.00	3.55	3.00	3.00
14	3.55	3.87	3.25	3.42	5.80	7.72	6.08	3.95	3.52	2.95	3.00
15	3.57	3.95	3.55	3.38	6.60	8.00	6.40	3.90	3.52	2.95	3.00
16	3.60	3.95	3.70	3.30	5.98	7.70	6.42	3.82	3.52	2.95	3.00
17	3.67	4.00	3.75	3.28	5.55	7.68	6.25	3.75	3.52	2.95	3.00
18	3.70	4.15	3.75	3.30	5.18	7.50	6.35	3.75	3.50	2.95	3.05
19	3.70	4.10	3.77	3.35	4.88	7.05	5.92	3.70	3.48	3.00	3.10
20	3.65	4.10	3.80	3.38	4.62	6.75	5.70	3.70	3.42	3.00	3.10
21	3.65	4.00	3.77	3.40	4.60	6.18	5.60	3.88	3.42	2.95	3.10
22	3.65	3.92	3.80	3.60	4.92	6.80	5.45	4.72	3.40	2.95	3.10
23	3.70	4.00	3.87	3.82	5.20	5.55	5.28	5.40	3.38	2.95	3.10
24	3.82	4.00	4.07	3.95	5.62	5.38	5.25	5.72	3.35	2.95	3.05
25	3.85	3.92	4.47	3.98	6.02	5.35	5.15	6.08	3.30	2.90	3.05
26	3.85	4.17	3.90	4.05	6.35	5.22	5.15	5.32	3.28	2.95	3.10
27	3.87	4.20	6.90	4.05	6.50	5.08	5.05	5.12	3.22	2.95	3.10
28	3.90	4.12	6.50	4.05	6.52	5.02	5.02	4.72	3.22	2.95	3.10
29	3.90	.....	5.55	3.85	6.48	5.12	4.82	4.45	3.18	2.95	3.10
30	3.90	.....	4.70	3.65	6.56	5.15	4.70	4.38	3.18	2.95	3.10
31	3.95	.....	4.55	.....	6.35	.....	4.50	4.20	.....	3.00	.....

NOTE.—Ice conditions January 1 to March 25.

Rating tables for Bighorn River at Fort Custer, Mont.

JANUARY 1, 1906, TO SEPTEMBER 8, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.00	2,230	4.10	5,110	5.10	8,560	6.20	13,980
3.10	2,450	4.20	5,410	5.20	8,960	6.40	15,180
3.20	2,680	4.30	5,720	5.30	9,380	6.60	16,440
3.30	2,920	4.40	6,040	5.40	9,820	6.80	17,760
3.40	3,170	4.50	6,370	5.50	10,280	7.00	19,140
3.50	3,430	4.60	6,710	5.60	10,760	7.20	20,560
3.60	3,700	4.70	7,060	5.70	11,260	7.40	22,040
3.70	3,970	4.80	7,420	5.80	11,780	7.60	23,580
3.80	4,250	4.90	7,790	5.90	12,300	7.80	25,160
3.90	4,530	5.00	8,170	6.00	12,840	8.00	26,800
4.00	4,820						

SEPTEMBER 9, 1906, TO NOVEMBER 30, 1906.[b]

2.90	1,400	3.20	2,090	3.40	2,600	3.60	3,150
3.00	1,620	3.30	2,340	3.50	2,870	3.70	3,440
3.10	1,850						

[a] This table is applicable only for open-channel conditions. It is based on eighteen discharge measurements made during 1904–6, and is well defined between gage heights 3 feet and 8 feet.

[b] This table is applicable only for open-channel conditions. It is based on three discharge measurements made subsequent to September 8, and is well defined between gage heights 3 feet and 3.5 feet.

Monthly discharge of Bighorn River at Fort Custer, Mont., for 1906.

[Drainage area, 20,700 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March 26–31	18,400	4,530	10,500	125,000	0.507	0.11
April	5,560	2,870	3,800	226,000	.184	.20
May	16,400	3,300	8,720	536,000	.421	.48
June	26,800	8,250	13,600	809,000	.657	.73
July	15,300	6,370	11,000	676,000	.531	.61
August	13,300	3,970	6,290	387,000	.304	.35
September	4,960	2,040	3,070	183,000	.148	.16
October	1,900	1,400	1,640	101,000	.079	.09
November	1,850	1,510	1,690	101,000	.082	.09
The period				3,140,000		

NOTE.—No estimate for ice period. Values are rated as follows: April to August, excellent; September to November, good.

LITTLE BIGHORN RIVER AT CROW AGENCY, MONT.

This station was established March 24, 1905, and was discontinued June 30, 1906. It is located at the Burlington and Missouri River Railroad bridge, one-fourth mile south of Crow Agency, Mont. During 1906 gage was read by Charles Town. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 111.

Discharge measurements of Little Bighorn River at Crow Agency, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 7[a]	H. M. Morse	77	166	3.06	275
March 8[a]	do	82	190	3.24	320
May 14	J. H. Sloan	99	383	5.23	1,490
June 19	R. H. Whinery	85	160	2.98	435
July 30	Richards and Whinery	[b]33	[b]29	2.00	108

[a] Ice above and below station. [b] Wading section.

Daily gage height, in feet, of Little Bighorn River at Crow Agency, Mont., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.3	3.5	2.3	3.5	2.4	3.5	17	2.3	4.15	2.5	2.3	3.5	3.3
2	2.3	3.5	2.45	3.1	2.4	3.4	18	2.3	3.9	2.6	2.4	3.4	3.2
3	2.4	3.3	2.7	3.0	2.3	3.3	19	2.3	4.0	2.5	2.4	3.2	3.1
4	2.3	2.9	2.7	2.8	2.3	3.3	20	2.3	3.85	2.5	2.4	3.0	2.9
5	2.4	2.8	2.4	2.7	2.4	3.2	21	2.4	3.35	2.7	2.3	3.0	2.9
6	2.4	2.7	2.4	2.8	2.4	3.5	22	2.4	3.15	2.8	2.3	3.2	2.7
7	2.4	2.5	2.9	3.1	2.4	3.6	23	2.4	4.0	2.9	2.4	3.4	2.7
8	2.4	2.4	3.3	3.0	2.4	3.6	24	2.4	4.3	3.4	2.4	3.6	2.6
9	2.4	2.4	3.4	2.9	2.3	3.3	25	2.4	3.65	4.2	2.4	3.9	2.7
10	2.4	2.5	4.3	2.8	2.3	3.2	26	2.4	3.05	5.7	2.5	4.1	2.7
11	2.4	2.5	3.5	2.6	2.2	3.2	27	2.5	2.85	7.0	2.5	4.1	2.6
12	2.3	2.6	3.7	2.5	2.2	3.3	28	2.4	2.25	5.8	2.5	4.0	2.6
13	2.3	2.7	3.3	2.5	2.5	3.3	29	2.5	.....	4.5	2.4	3.8	2.7
14	2.3	2.7	2.8	2.5	7.2	3.4	30	2.5	.....	4.1	2.4	4.0	2.6
15	2.3	2.7	2.7	2.4	3.6	3.4	31	2.8	.....	3.6	.....	3.7	.....
16	2.3	2.6	2.7	2.4	3.5	3.3							

NOTE.—Ice conditions January 14 to March 27.

Rating table for Little Bighorn River at Crow Agency, Mont., for 1905–6.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	105	3.00	430	4.00	860	5.00	1,360
2.10	130	3.10	470	4.10	910	5.20	1,465
2.20	155	3.20	510	4.20	960	5.40	1,575
2.30	185	3.30	550	4.30	1,010	5.60	1,685
2.40	215	3.40	590	4.40	1,060	5.80	1,795
2.50	250	3.50	630	4.50	1,110	6.00	1,915
2.60	285	3.60	675	4.60	1,160	7.00	2,515
2.70	320	3.70	720	4.70	1,210		
2.80	355	3.80	765	4.80	1,260		
2.90	390	3.90	810	4.90	1,310		

NOTE.—The above table is applicable only for open-channel conditions. It is based on thirteen discharge measurements made during 1905 and 1906, and is well defined between gage heights 1.9 feet and 5.0 feet.

[a] Except March 1–27, when estimates were based on two measurements made during that time.

Monthly discharge of Little Bighorn River at Crow Agency, Mont., for 1906.

[Drainage area 1,280 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January (1–13)	215	185	203	5,230	0.159	0.077
March	1,800	110	476	29,300	.372	.43
April	630	185	290	17,300	.226	.25
May	2,740	155	543	33,400	.424	.49
June	675	285	475	28,300	.372	.42
The period	.....	.....	.....	114,000	.....	.....

NOTE.—Values are rated as follows: January, good; April to June, excellent; the results for March are based on a special ice curve, and are approximate.

BIG WIND RIVER NEAR ARAPAHOE AGENCY, WYO.

This station was established May 14, and was discontinued August 25, 1906. It is located at Walkers Ferry, 7 miles northeast of Arapahoe Agency.

The channel is straight for 800 feet above and below the station. The banks are covered with heavy willow brush and are not liable to overflow. The bed of the stream is of cobblestone, with the exception of the portion near the left bank, which is composed of sand, and shifts somewhat. The current is swift.

Discharge measurements were made from the ferry at high stages and by small car suspended from the ferry cable, or by wading, at lower stages.

The gage, which was read by Andrew Walker, is a hewn timber fastened to the downstream side of the elevated approach to the ferry. The bench mark is the top of a small stump near the bank of the river 11.5 feet southeast of the gage; elevation, 6.00 feet above the gage datum. On July 13, owing to a change in channel during high water, a new gage was installed at a point 600 feet above old gage. A new curve applies from July 13.

Discharge measurements of Big Wind River near Arapahoe Agency, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 14	A. J. Parshall	236	743	3.30	4,020
May 15	do	236	660	3.00	3,400
June 8	do	236	618	2.80	3,050
June 10	do	236	581	2.60	2,570
June 12	do	237	865	3.70	5,240
June 12	do	240	1,060	4.55	7,502
June 13	do	240	1,220	5.20	9,480
July 13	do	240	902	3.50	5,830
July 18	do	240	686	2.65	3,700
July 19	do	240	734	2.85	4,150
November 13	R. I. Meeker	125	218	0.05	374

NOTE.—Beginning July 13 the gage heights for the remainder of the year refer to the new gage established on that date.

Daily gage height, in feet, of Big Wind River near Arapahoe Agency, Wyo., for 1906.

Day.	May.	June.	July.	Aug.	Day.	May.	June.	July.	Aug.
1		2.7	2.6	2.1	17	2.4	5.4	2.65	1.6
2		2.5	2.6	2.0	18	2.2	3.9	2.65	1.65
3		2.6	2.65	2.1	19	2.4	3.4	2.85	2.6
4		2.8	2.65	3.3	20	2.3	2.4	2.8	3.1
5		2.9	2.7	2.2	21	3.0	2.6	2.65	3.3
6		3.2	2.7	2.25	22	3.0	2.9	2.8	3.3
7		3.0	2.7	2.3	23	2.8	2.8	3.0	3.1
8		2.8	2.75	2.05	24	3.1	3.0	2.9	3.4
9		2.6	2.75	1.9	25	3.6	2.6	2.95	2.75
10		2.6	2.8	1.85	26	3.6	2.9	2.7	
11		3.8	2.85	1.75	27	3.7	2.7	2.5	
12		4.6	2.8	1.8	28	3.1	2.5	2.4	
13		5.2	3.45	1.7	29	3.8	2.6	2.3	
14	3.3	6.0	3.25	1.7	30	3.4	2.7	2.45	
15	3.0	5.5	3.0	1.65	31	3.0		2.4	
16	2.8	5.2	2.85	1.7					

NOTE.—Beginning July 13 the gage heights refer to the new gage established on that date. From July 1-13 the gage heights were estimated.

Rating tables for Big Wind River near Arapahoe Agency, Wyo.

MAY 14, 1906, TO JULY 12, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.10	1,760	3.10	3,610	4.10	6,150	5.10	9,220
2.20	1,910	3.20	3,830	4.20	6,440	5.20	9,550
2.30	2,070	3.30	4,060	4.30	6,730	5.30	9,880
2.40	2,240	3.40	4,300	4.40	7,030	5.40	10,210
2.50	2,420	3.50	4,550	4.50	7,330	5.50	10,550
2.60	2,600	3.60	4,810	4.60	7,640	5.60	10,890
2.70	2,790	3.70	5,070	4.70	7,950	5.70	11,230
2.80	2,990	3.80	5,330	4.80	8,260	5.80	11,580
2.90	3,190	3.90	5,600	4.90	8,580	5.90	11,930
3.00	3,400	4.00	5,870	5.00	8,900	6.00	12,280

JULY 13, 1906, TO AUGUST 25, 1906.[b]

1.60	1,800	2.10	2,600	2.60	3,590	3.10	4,750
1.70	1,940	2.20	2,790	2.70	3,810	3.20	5,010
1.80	2,090	2.30	2,980	2.80	4,030	3.30	5,280
1.90	2,250	2.40	3,180	2.90	4,260	3.40	5,550
2.00	2,420	2.50	3,380	3.00	4,500	3.50	5,830

[a] This table is based on seven discharge measurements made during May and June, 1906, and is well defined between gage heights 2.5 feet and 6.0 feet.

[b] This table is based on four discharge measurements made during July–November, 1906, and is well defined between gage heights 2.5 feet and 4 feet.

Monthly discharge of Big Wind River near Arapahoe Agency, Wyo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May (14–31)	5,330	1,760	3,550	127,000
June	12,300	2,240	4,480	267,000
July	5,690	2,600	3,500	215,000
August (1–25)	5,550	1,800	3,080	153,000
The period				762,000

NOTE.—Values for May to July are probably excellent; the values for August do not compare well with those for the two stations on the Little Wind River and are probably approximate.

LITTLE WIND RIVER ABOVE ARAPAHOE AGENCY, WYO.

This station was established May 11 and discontinued October 31, 1906. It is located at the Government bridge above the junction with Popo Agie River and one-half mile above the post-office at Arapahoe Agency.

The channel curves both above and below the station. The water is confined between the bridge abutments. The bed is of cobblestone, and permanent. The current is swift.

Discharge measurements were made from the downstream side of the bridge. The initial point for soundings is marked zero on the top rail of the bridge at the left bank.

The gage, which was read by G. A. Bremner, is a staff attached to the downstream side of the pile bent nearest the left bank. The bench mark is a spike in a telephone pole N. 20° W. 40 feet from the gage; elevation, 6.86 feet above the gage datum.

Discharge measurements of Little Wind River above Arapahoe Agency, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 11	A. J. Parshall	100	161	1.90	680
May 12	do	100	139	1.70	510
May 13	do	100	183	2.20	880
May 15	do	100	166	2.00	760
June 7	do	100	210	2.35	1,130
June 8	do	100	182	2.15	880
June 9	do	100	166	1.95	730
June 10	do	100	186	2.15	890
June 11	do	100	245	2.70	1,470
June 12	do	100	305	3.30	2,040
June 12	do	100	265	2.90	1,650
June 13	do	100	325	3.50	2,260
June 13	do	100	349	3.75	2,570
June 14	do	100	375	4.00	2,880
July 12	do	100	229	2.50	1,220
July 13	do	100	238	2.60	1,330
July 14	do	100	250	2.75	1,460
July 16	do	100	220	2.40	1,110
July 17	do	100	210	2.30	1,050
July 18	do	100	201	2.20	960
July 19	do	100	190	2.10	890
November 13	R. I. Meeker	94	63	.73	104

Daily gage height, in feet, of Little Wind River above Arapahoe Agency, Wyo., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1		1.9	2.2	1.5	1.0	0.7	17	1.6	3.95	2.3	1.0	0.85	0.5
2		1.9	2.5	1.5	1.0	.7	18	1.5	3.3	2.3	.95	.8	[illegible]
3		2.2	2.5	1.5	1.0	.65	19	1.6	2.9	2.3	.95	.8	[illegible]
4		2.3	2.6	1.6	1.0	.65	20	1.7	2.6	2.1	1.4	.8	[illegible]
5		2.6	2.7	1.5	.95	.65	21	1.8	2.5	2.0	1.7	.8	[illegible]
6		2.8	2.7	1.5	.9	.6	22	2.0	2.7	2.0	1.8	.8	[illegible]
7		2.2	2.8	1.4	.9	.6	23	2.3	2.5	1.9	1.8	.8	[illegible]
8		2.1	2.9	1.3	.85	.6	24	3.0	2.3	2.0	1.4	.75	[illegible]
9		2.0	2.6	1.2	.85	.6	25	3.3	2.1	2.0	1.3	.7	[illegible]
10		2.3	2.7	1.1	.85	.6	26	2.8	2.2	1.9	1.3	.7	[illegible]
11	1.9	2.9	2.5	1.1	.8	.6	27	2.3	2.2	1.8	1.4	.7	[illegible]
12	1.7	3.3	2.8	1.0	.8	.6	28	3.0	2.3	1.7	1.3	.7	[illegible]
13	2.2	3.7	2.6	1.0	.8	.55	29	2.8	2.2	1.6	1.2	.7	[illegible]
14	2.0	3.9	2.75	1.1	.8	.5	30	2.5	2.0	1.5	1.1	.7	[illegible]
15	1.9	4.0	2.8	1.1	.75	.5	31	2.1	.....	1.5	1.0	...	[illegible]
16	1.8	3.8	2.5	1.0	.85	.5							

Rating table for Little Wind River above Arapahoe Agency, Wyo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.50	50	1.40	365	2.30	1,030	3.20	1,955
.60	72	1.50	420	2.40	1,130	3.30	2,060
.70	97	1.60	480	2.50	1,230	3.40	2,170
.80	125	1.70	545	2.60	1,330	3.50	2,280
.90	157	1.80	615	2.70	1,430	3.60	2,390
1.00	192	1.90	685	2.80	1,535	3.70	2,500
1.10	230	2.00	760	2.90	1,640	3.80	2,610
1.20	270	2.10	845	3.00	1,745	3.90	2,725
1.30	315	2.20	935	3.10	1,850	4.00	2,840

NOTE.—The above table is applicable only for open-channel conditions. It is based on twenty-two discharge measurements made during 1906 and is well defined between gage heights 1.7 feet and 4 feet. Below gage height 1.7 feet it is based on one measurement.

Monthly discharge of Little Wind River above Arapahoe Agency, Wyo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May (11-31)	2,060	420	966	40,200
June	2,840	685	1,410	83,900
July	1,640	420	1,050	64,600
August	615	174	325	20,000
September	192	97	134	7,970
October	125	50	78.3	4,810
The period				221,000

NOTE.—Values for 1906 are excellent.

LITTLE WIND RIVER BELOW ARAPAHOE AGENCY, WYO.

This station was established May 11, and was discontinued October 31, 1906. It is located at the Government bridge 200 yards below the junction of Popo Agie River and one-half mile south of the post-office at Arapahoe Agency.

The channel is straight for 500 feet above and 1,000 feet below the bridge abutments. During high water a small slough carries water not registered on gage. The bed of the stream is permanent. The water is swift except at low stages.

Discharge measurements were made from the bridge. The initial point for soundings is marked zero on top of the hand rail, downstream side, left bank.

The gage, which was read by G. A. Bremner, is a staff attached to the downstream side of the pile bent nearest the left bank. The bench mark is a spike in an 18-inch cottonwood tree N. 20° W. about 200 feet from the gage; elevation, 11.97 feet above the gage datum.

Discharge measurements of Little Wind River below Arapahoe Agency, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 11	A. J. Parshall	103	580	3.90	1,830
May 12	do	101	603	4.20	2,150
May 13	do	104	658	4.60	2,690
June 7	do	104	669	4.70	2,800
June 8	do	102	584	4.10	1,960
June 9	do	102	595	4.05	1,920
June 10	do	102	654	4.65	2,730
June 11	do	103	738	5.40	3,540
June 11	do	103	774	5.70	4,110
June 12	do	108	863	6.50	5,180
June 12	do	104	800	5.90	4,390
June 13	do	108	885	6.70	5,520
June 13	do	110	952	7.30	6,640
June 14	do	110	972	7.50	6,950
July 12	do	102	678	4.80	2,850
July 13	do	102	710	5.10	3,220
July 14	do	103	751	5.50	3,860
July 16	do	102	662	4.70	2,680
July 17	do	102	640	4.50	2,420
July 19	do	102	628	4.40	2,250
November 13	R. I. Meeker	96	355	1.64	270

Daily gage height, in feet, of Little Wind River below Arapahoe Agency, Wyo., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	4.1	4.1	2.9	2.3	1.65	17	3.6	6.8	4.5	2.2	2.0	1.4
2	.....	4.05	4.5	2.85	2.3	1.65	18	3.4	5.9	4.5	2.1	2.0	1.4
3	.....	4.2	4.45	2.8	2.25	1.6	19	3.6	5.2	4.35	2.1	2.0	1.5
4	.....	4.4	4.5	2.9	2.2	1.6	20	4.2	4.7	4.1	3.0	2.0	1.5
5	.....	5.0	4.6	2.8	2.1	1.6	21	4.6	4.6	4.0	3.5	2.0	1.5
6	.....	5.5	4.7	2.8	2.0	1.6	22	4.7	4.85	3.95	3.7	2.0	1.5
7	.....	4.6	5.2	2.7	2.0	1.6	23	4.9	4.6	3.9	3.7	2.0	1.6
8	.....	4.15	5.0	2.6	1.95	1.6	24	6.0	4.2	3.9	3.3	1.9	1.7
9	.....	4.05	4.6	2.5	1.9	1.6	25	6.4	3.85	3.8	3.2	1.8	1.9
10	.....	4.65	4.7	2.45	1.9	1.6	26	5.7	3.9	3.6	3.2	1.8	1.9
11	3.9	5.7	4.7	2.4	1.9	1.6	27	5.3	4.0	3.35	3.3	1.75	1.9
12	4.2	6.5	4.9	2.3	1.9	1.5	28	5.55	4.2	3.25	2.6	1.7	1.9
13	4.6	7.3	5.1	2.2	1.9	1.5	29	5.5	4.0	3.1	2.5	1.7	1.85
14	4.2	7.5	5.55	2.3	1.9	1.45	30	5.0	3.6	3.05	2.5	1.7	1.8
15	4.1	6.8	5.4	2.3	1.9	1.4	31	4.3	.....	2.9	2.3	.....	1.8
16	4.0	6.75	4.7	2.2	2.0	1.4							

Rating table for Little Wind River below Arapahoe Agency, Wyo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	200	2.70	805	4.00	1,910	5.40	3,640
1.50	225	2.80	875	4.10	2,015	5.60	3,920
1.60	255	2.90	945	4.20	2,125	5.80	4,210
1.70	285	3.00	1,020	4.30	2,235	6.00	4,500
1.80	320	3.10	1,095	4.40	2,345	6.20	4,810
1.90	360	3.20	1,175	4.50	2,460	6.40	5,120
2.00	405	3.30	1,255	4.60	2,580	6.60	5,430
2.10	450	3.40	1,340	4.70	2,705	6.80	5,740
2.20	500	3.50	1,430	4.80	2,830	7.00	6,060
2.30	555	3.60	1,520	4.90	2,960	7.20	6,385
2.40	615	3.70	1,615	5.00	3,090	7.40	6,715
2.50	675	3.80	1,710	5.20	3,360	7.60	7,045
2.60	740	3.90	1,810				

NOTE.—The above table is applicable only for open-channel conditions. It is based on twenty-one discharge measurements made during 1906 and is well defined between gage heights 3.9 feet and 8.0 feet. The extension below 3.9 is based on one measurement at 1.64.

Monthly discharge of Little Wind River below Arapahoe Agency, Wyo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May (11-31)	5,120	1,340	2,740	114,000
June	6,880	1,520	3,200	190,000
July	3,850	945	2,290	141,000
August	1,620	450	845	52,000
September	555	285	390	23,200
October	360	200	263	16,200
The period	.....	.....	.....	536,000

NOTE.—Values for 1906 are excellent.

SHOSHONE RIVER NEAR CODY, WYO.

This station was established April 26, 1902. It is located at the wagon bridge 1 mile northeast of Cody, Wyo., in sec. 29, T. 53 N., R. 101 W. The gage was read during 1906 by H. N. Bickel. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 113, where are given also references to publications that contain data for previous years.

Discharge measurements of Shoshone River near Cody, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 26	Brundage and Bickel	90	197	1.80	214
March 7	do	90	216	1.90	276
March 13	Brundage and Craig	90	171	1.45	114
March 28	Brundage and Polk	107	235	2.03	313
April 7	J. H. Sloan	128	346	2.75	821
March 31	Harley and Brundage	158	607	4.12	2,660
October 18	Harley and Coleman	128	265	2.12	386

Daily gage height, in feet, of Shoshone River near Cody, Wyo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.85	2.0	2.0	2.5	2.8	4.08	5.5	3.75	3.0	2.2	2.15	1.9
2	1.8	1.95	2.0	2.4	3.0	4.08	5.7	3.7	2.9	2.2	2.15	1.9
3	1.9	2.0	2.0	2.2	3.0	4.3	5.6	3.5	2.85	2.15	2.1	2.0
4	1.85	2.0	1.95	2.1	3.4	4.5	5.3	3.6	2.8	2.2	2.1	2.1
5	1.9	2.0	1.95	2.2	3.25	4.7	5.5	3.5	2.8	2.2	2.1	2.1
6	2.0	2.0	1.95	2.45	3.0	4.8	5.7	3.4	2.8	2.2	2.1	2.05
7	1.95	1.95	1.95	2.75	3.0	4.4	5.4	3.4	2.8	2.2	2.1	2.1
8	1.9	2.0	1.95	3.0	3.2	4.1	5.3	3.5	2.75	2.2	2.15	2.1
9	1.9	2.0	1.95	2.8	3.8	4.1	5.4	3.4	2.7	2.25	2.2	2.1
10	1.95	2.0	1.95	2.6	4.4	4.52	5.5	3.45	2.75	2.25	2.18	2.0
11	1.95	1.95	1.95	2.6	4.7	5.6	5.6	3.35	2.7	2.1	2.2	2.1
12	1.9	1.95	1.95	2.5	4.7	6.1	5.4	3.35	2.6	2.1	2.16	2.1
13	1.95	2.0	2.0	2.4	5.4	7.4	5.6	3.4	2.55	2.1	2.15	2.0
14	1.95	1.95	1.95	2.35	5.0	6.4	5.5	3.4	2.5	2.1	2.25	1.9
15	1.95	1.95	2.0	2.5	4.5	5.9	5.7	3.1	2.65	2.07	2.7	1.8
16	2.0	2.0	2.0	2.9	4.2	6.0	5.1	3.1	2.6	2.05	2.65	1.7
17	2.0	2.0	2.0	3.0	3.7	5.7	5.0	3.1	2.5	2.12	2.2	1.7
18	1.9	1.95	1.95	2.9	3.6	5.0	5.3	3.05	2.5	2.13	2.0	1.95
19	1.8	1.95	1.95	2.85	3.7	4.75	4.9	3.35	2.5	2.1	1.72	2.0
20	2.0	2.0	2.0	3.05	4.3	4.4	4.8	3.6	2.45	2.07	1.75	2.0
21	2.0	2.0	2.0	3.6	4.5	4.45	4.7	3.5	2.45	2.05	1.85	2.1
22	2.0	1.95	1.95	4.1	4.1	4.8	4.6	4.0	2.4	2.0	2.05	2.1
23	2.0	1.95	2.0	4.2	4.35	4.4	4.8	4.0	2.4	2.0	2.1	2.0
24	2.0	1.95	2.0	3.8	5.1	4.2	4.5	3.7	2.35	2.0	2.0	2.0
25	2.0	2.0	2.0	3.35	4.8	4.05	4.5	3.4	2.3	2.1	2.0	2.1
26	1.95	2.0	2.1	3.2	4.9	4.25	4.3	3.3	2.3	2.1	2.05	2.1
27	1.95	2.0	2.1	3.05	4.5	4.6	4.2	3.25	2.25	2.2	2.0	2.1
28	2.0	2.0	2.0	2.9	4.4	4.85	4.0	3.2	2.25	2.2	1.9	2.05
29	2.0	.....	2.1	3.1	4.9	4.45	3.9	3.1	2.2	2.15	1.9	2.0
30	1.95	.....	2.15	2.9	4.4	4.3	3.8	3.05	2.25	2.15	2.05	2.0
31	2.0	.....	2.15	.....	4.2	.....	3.8	3.0	.....	2.0	.....	1.8

NOTE.—Practically open-channel conditions during the entire year.

Rating table for Shoshone River near Cody, Wyo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.50	125	2.70	780	3.90	2,320	5.20	5,280
1.60	155	2.80	870	4.00	2,500	5.40	5,840
1.70	190	2.90	970	4.10	2,690	5.60	6,420
1.80	225	3.00	1,070	4.20	2,890	5.80	7,030
1.90	265	3.10	1,180	4.30	3,100	6.00	7,660
2.00	310	3.20	1,300	4.40	3,310	6.20	8,310
2.10	360	3.30	1,420	4.50	3,530	6.40	8,980
2.20	415	3.40	1,550	4.60	3,760	6.60	9,670
2.30	475	3.50	1,690	4.70	4,000	6.80	10,380
2.40	545	3.60	1,840	4.80	4,240	7.00	11,110
2.50	620	3.70	1,990	4.90	4,490		
2.60	700	3.80	2,150	5.00	4,750		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–6 and is well defined.

Monthly discharge of Shoshone River near Cody, Wyo., for 1906.

[Drainage area, 1,480 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	310	225	285	17,500	0.193	0.22
February	310	287	301	16,700	.203	.21
March	388	287	310	19,100	.209	.24
April	2,890	360	1,030	61,300	.696	.78
May	5,840	870	2,890	178,000	1.95	2.25
June	12,600	2,650	4,550	271,000	3.07	3.42
July	6,720	2,150	4,860	299,000	3.28	3.78
August	2,500	1,070	1,580	97,200	1.07	1.23
September	1,070	415	680	40,500	.459	.51
October	445	310	376	23,100	.254	.29
November	780	197	371	22,100	.251	.28
December	360	190	313	19,200	.211	.24
The year	12,600	190	1,460	1,060,000	.987	13.45

NOTE.—Values are rated as follows: January to March, approximate, on account of erroneous gage heights; April to December, excellent.

SOUTH FORK OF SHOSHONE RIVER AT MARQUETTE, WYO.

This station was established April 26, 1903, but was discontinued during 1904. It was located at the county highway bridge at Marquette, 12 miles west of Cody. April 4, 1906, the station was reestablished 1¾ miles below Marquette, one-half mile above the Shoshone dam, and one-fourth mile above the mouth of North Fork.

The channel is straight for 200 feet above and 300 feet below the gage section. The right bank is high and clean, and not liable to overflow; the left is low and wooded, but not liable to overflow. The bed of the stream is gravelly and permanent. There is an overflow channel at high water.

Discharge measurements are made from a cable and car located three-fourths mile above the gage section. Two small creeks enter the river between the cable section and gage. Their discharge is measured and added to that at the cable in order to get the flow at the gage.

The gage, which is read daily by W. T. Coleman, is a vertical staff fastened to a 20-inch cottonwood tree on the right bank. The bench mark is a spike driven into the tree to which the gage is attached, elevation, 6.50 feet above the gage datum.

Discharge measurements of South Fork of Shoshone River at Marquette, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 8	J. H. Sloan	83	143	1.65	306
April 12	G. F. Harley	79	114	1.33	199
April 14	do	77	108	1.22	169
April 17	do	95	141	1.72	336
April 21	do	135	184	2.21	583
May 9	do	135	197	2.34	628
May 12	do	138	270	2.89	1,210
May 29	do	139	306	3.14	1,550
June 11	do	139	359	3.58	2,120
October 17	do	89	65	.96	101

Daily gage height, in feet, of South Fork of Shoshone River at Marquette, Wyo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.51	2.46	3.50	2.30	1.90	1.05	1.20
2	.....	1.63	2.52	3.80	2.25	1.70	1.00	1.20
3	.....	1.62	2.78	3.60	2.05	1.70	1.00	1.20
4	1.05	1.98	2.95	3.60	2.50	1.50	1.00	1.20
5	1.15	1.77	3.08	3.60	2.15	1.55	1.00	1.20
6	1.20	1.66	2.90	3.60	2.50	1.45	.95	1.15
7	1.45	1.63	3.15	3.40	2.45	1.40	.95	1.10
8	1.68	1.75	2.48	3.45	2.20	1.50	.95	1.20
9	1.50	2.35	2.48	3.25	2.15	1.40	1.25	1.20
10	1.40	2.78	2.94	3.50	2.10	1.45	1.30	1.30
11	1.30	2.95	3.69	3.40	2.00	1.50	1.00	1.30
12	1.34	3.02	4.20	3.60	2.00	1.40	1.00	1.30
13	1.22	4.22	5.10	3.70	1.90	1.40	1.00	1.30
14	1.22	3.10	4.20	3.60	1.90	1.35	.95	1.35
15	1.32	2.89	3.55	3.60	1.90	1.40	.95	1.50
16	1.52	2.54	4.00	3.45	1.80	1.35	.95	1.50
17	1.72	2.22	3.60	3.50	1.65	1.40	.95	1.50
18	1.63	2.12	3.20	3.45	1.65	1.30	.95	.....
19	1.52	2.18	2.85	3.10	2.00	1.30	1.10	.....
20	1.72	2.70	2.60	3.00	3.00	1.30	1.10	.....
21	2.21	2.80	2.72	3.00	2.30	1.30	1.00	.....
22	2.55	2.52	3.00	3.10	2.90	1.30	1.10	.....
23	2.60	2.60	2.65	3.10	2.60	1.25	1.00	.....
24	2.25	3.42	2.35	2.90	2.50	1.25	1.15	.....
25	1.95	3.10	2.35	2.90	2.20	1.20	1.00	.....
26	1.80	3.20	2.70	2.70	2.10	1.20	1.15	.....
27	1.56	2.89	3.10	2.70	1.90	1.20	1.20	.....
28	1.58	2.85	3.10	2.50	1.90	1.10	1.20	.....
29	1.68	3.20	2.65	2.50	1.80	1.10	1.25	.....
30	1.60	2.80	2.55	2.40	1.80	1.05	1.20	.....
31	.....	2.62	.....	2.35	1.80	.....	1.20	.....

NOTE.—From November 17 to December 31 the river was gorged with ice. Gage heights interpolated June 18–19.

Rating table for South Fork of Shoshone River at Marquette, Wyo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	95	1.90	413	2.90	1,220	3.90	2,590
1.00	115	2.00	463	3.00	1,340	4.00	2,740
1.10	137	2.10	518	3.10	1,460	4.20	3,060
1.20	161	2.20	578	3.20	1,590	4.40	3,380
1.30	188	2.30	648	3.30	1,720	4.60	3,710
1.40	218	2.40	723	3.40	1,860	4.80	4,050
1.50	251	2.50	808	3.50	2,000	5.00	4,390
1.60	287	2.60	900	3.60	2,140		
1.70	326	2.70	1,000	3.70	2,290		
1.80	368	2.80	1,110	3.80	2,440		

NOTE.—The above table is applicable only for open-channel conditions. It is based on ten discharge measurements made during 1906 and is well defined between gage heights 1 foot and 4 feet.

Monthly discharge of South Fork of Shoshone River at Marquette, Wyo., for 1906.

[Drainage area, 500 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April (4-30)	900	126	325	17,400	0.650	0.65
May	3,090	255	971	59,700	1.94	2.24
June	4,560	686	1,500	89,300	3.00	3.35
July	2,440	686	1,660	102,000	3.32	3.85
August	1,340	306	577	35,500	1.15	1.33
September	413	126	215	12,800	.430	.48
October	188	105	129	7,930	.258	.30
November			[a] 127	7,560	.254	.28
December			[a] 106	6,520	.212	.24
The year				339,000		

[a] The flow during the frozen period has been estimated from that at Cody, where practically open-channel conditions exist.

NOTE.—Values are rated as follows: April to October, excellent; November and December, good.

PINEY CREEK AT KEARNEY, WYO.

This station was established September 6, 1902, and was discontinued June 30, 1906. It was located at the highway bridge about 100 yards south of the Kearney post-office, at the crossing of the stage road from Buffalo to Sheridan, on the water front of the Geier ranch. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 117, where are given also references to publications that contain data for previous years.

Discharge measurements of Piney Creek at Kearney, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 10	J. H. Sloan	40	72	1.52	61
June 16	R. H. Whinery	47	95	2.33	273

Daily gage height, in feet, of Piney Creek at Kearney, Wyo., for 1906.

Day.	Apr.	May.	June.	Day.	Apr.	May.	June.
1		1.82	2.24	17	1.47	2.49	2.09
2		1.72	2.17	18	1.52	2.37	1.97
3		1.72	2.17	19	1.52	2.32	1.82
4		1.92	2.29	20	1.57	2.57	1.69
5		1.92	2.49	21	1.67	2.79	1.39
6		1.72	2.89	22	1.77	2.67	1.22
7		1.67	2.39	23	1.87	2.67	1.14
8		1.47	2.19	24	1.97	2.82	1.09
9		1.67	2.12	25	1.92	2.97	.94
10	1.52	1.77	2.09	26	1.92	2.64	.84
11	1.47	1.97	2.52	27	1.87	2.59	.97
12	1.42	2.27	2.54	28	1.87	2.84	1.09
13	1.37	2.82	2.74	29	1.92	2.94	1.04
14	1.32	2.82	2.67	30	1.87	2.47	1.12
15	1.32	2.69	2.34	31		2.34	
16	1.42	2.77	2.22				

Rating table for Piney Creek at Kearney, Wyo., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	8	1.40	52	2.00	162	2.60	400
0.90	12	1.50	64	2.10	192	2.70	460
1.00	17	1.60	78	2.20	225	2.80	525
1.10	24	1.70	94	2.30	262	2.90	595
1.20	32	1.80	113	2.40	302	3.00	675
1.30	41	1.90	136	2.50	347		

NOTE.—The above table is applicable only for open-channel conditions. It is based on ten discharge measurements made during 1905 and 1906, and is well defined between gage heights 1.1 feet and 3 feet.

Monthly discharge of Piney Creek at Kearney, Wyo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April (10–30)	154	43	91.8	3,820
May	651	60	322	19,800
June	588	10	191	11,400
The period				35,000

NOTE.—Values for 1906 are probably excellent.

MISCELLANEOUS MEASUREMENT.

On June 7, 1906, Cooley Creek was measured at Lavina, Mont.; the estimated discharge was 35 second-feet.

LITTLE MISSOURI RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The Little Missouri rises in the central part of Crook County, in northeastern Wyoming, flows northeastward, crossing the southeast corner of Montana and the northwest corner of South Dakota and empties into the Missouri in North Dakota, in the Fort Berthold Indian Reservation. The stream receives numerous small tributaries, most of which are dry for the greater part of the year. The main floods occur during March, May, June, and July. During the rainy season some water is diverted from the tributaries, and a small quantity is stored for irrigation. The data collected in this basin are valuable for irrigation purposes.

LITTLE MISSOURI RIVER AT ALZADA, MONT.

This station was established April 3, 1904, at the highway bridge one-half mile northeast of Alzada. April 17, 1906, the station was moved to a footbridge just back of Mr. King's house in Alzada.

The channel is straight for 200 feet above and 150 feet below the gage. Both banks are high, but are liable to overflow at extreme high water. The bed of the stream is composed of silt, sand, and gravel, and is fairly permanent. The current is moderately swift.

except at low water. There is but one channel at all stages. Willows and brush on the banks tend to retard the flow during high water.

Discharge measurements are made at high stages from the footbridge. The initial point for sounding is the 10-foot mark on the gage. Low-water measurements are made by wading 200 feet below the gage.

The gage, which was read during 1906 once each day by Miss Essie King, is an inclined timber spiked to posts driven firmly into the bank of the stream. The bench mark is a spike driven in a large cottonwood tree at the west end of the footbridge; elevation, 14.97 feet above the gage datum.

Discharge measurements of Little Missouri River at Alzada, Mont., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 17	H. D. Comstock	24	23	3.05	37
May 15	J. E. Stewart	19	9	2.54	10
November 13	do			2.25	[a] 2

[a] Estimated.

NOTE.—These measurements were made at different sections.

Daily gage height, in feet, of Little Missouri River at Alzada, Mont., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1			5.6	3.7	2.3	2.2	2.5	2.2	2.2
2			11.5	3.0	2.3	2.2	2.2	2.2	2.2
3			12.85	2.2	2.3	2.2	2.2	2.2	2.2
4			7.0	2.3	2.2	2.2	2.2	2.2	2.2
5			3.85	2.4	2.2	2.2	2.2	2.2	2.2
6			3.5	2.2	2.2	2.2	2.2	2.2	2.2
7			3.0	2.2	2.2	4.0	2.2	2.2	2.2
8			3.0	2.3	2.2	5.4	2.2	2.2	2.2
9			2.9	2.3	2.2	5.3	2.2	2.2	2.2
10			2.7	4.8	2.2	4.0	2.2	2.2	2.2
11	9.4		2.7	3.8	2.2	3.0	2.2	2.2	2.2
12	11.0		2.7	3.1	4.3	2.6	2.2	2.2	2.2
13	14.0		2.7	2.6	2.5	2.2	2.2	2.2	2.2
14	9.0		2.7	2.1	2.3	2.2	2.2	2.2	2.2
15	7.0		2.5	2.0	2.2	2.0	2.2	2.2	2.2
16	5.0		2.5	2.0	2.2	2.0	2.2	2.2	2.2
17	4.3	3.1	2.5	5.0	2.2	2.0	2.2	2.2	2.2
18	3.0	3.8	2.5	4.3	2.2	2.0	2.2	2.2	2.2
19	3.0	2.7	2.4	2.9	2.2	2.0	2.2	2.2	2.2
20	2.6	2.6	2.4	2.5	2.2	2.0	2.2	2.2	2.2
21	2.6	2.6	2.4	2.4	2.2	8.0	2.2	2.2	2.2
22	2.4	2.6	2.5	2.3	2.2	9.5	2.2	2.2	2.2
23	2.4	2.5	2.5	2.3	2.2	10.0	2.2	2.2	2.2
24	2.4	2.5	4.0	2.3	2.2	3.0	2.2	2.2	2.2
25	4.0	2.5	12.0	2.3	2.2	2.0	2.2	2.2	2.2
26	14.0	2.5	10.7	2.3	2.2	4.0	2.2	2.2	2.2
27	17.5	2.5	7.0	2.3	2.2	4.0	2.2	2.2	2.2
28	12.5	2.4	7.0	2.3	2.2	3.5	2.2	2.2	2.2
29	8.0	2.5	6.35	2.3	2.2	2.7	2.2	2.2	2.2
30	7.0	2.7	5.15	2.3	2.2	2.5	2.2	2.2	2.2
31	5.0		4.55		2.2	2.5		2.2	

NOTE.—Gage heights for March refer to the original station. For the remainder of the year the gage heights refer to the new station.

LITTLE MISSOURI RIVER AT CAMP CROOK, S. DAK.

This station was established September 2, 1903. It is located at the old highway bridge on the road from Camp Crook to Bellefourche, about one-half mile from Camp Crook in T. 18 N., R. 1 E. The conditions at this station are described in Water-Supply Paper No. 172, page 123, where are given also references to publications that contain data for previous years.

High-water measurements are made from the downstream side of the new highway bridge; low-water measurements are made by wading near the bridge.

A standard chain gage was established April 14, 1906. It is bolted to the hand rail on the upstream side of the bridge; length of chain, 19.20 feet, and elevation of center of pulley, 18.32 feet. The bench mark is a spike driven in a cottonwood tree 50 feet southeast of the south end of the bridge; elevation, 9.47 feet above the gage datum.

Discharge measurements of Little Missouri River at Camp Crook, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 14	Comstock and Stewart	126	195	1.90	432
April 15	do	134	407	3.67	1,300
April 15	do	134	415	3.98	1,380
May 15	J. E. Stewart	[a] 76	[a] 56	.65	57
November 14	do	[a] 24	[a] 12	.26	9.2

[a] Wading section.

Daily gage height, in feet, of Little Missouri River at Camp Crook, S. Dak., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	3.2	0.6	1.9	0.5	0.2	3.0	0.3	0.3
2	3.0	.6	1.5	.5	.3	2.8	.3	.3
3	2.8	3.3	1.1	.4	.5	2.4	.3	.3
4	2.6	4.0	1.0	.4	.9	2.0	.3	.25
5	2.0	4.0	.9	.4	.8	1.2	.3	.25
6	1.6	4.0	2.4	.4	.7	.7	.3	.25
7	1.2	2.1	3.5	.4	.5	.6	.3	.25
8	1.2	1.1	4.9	.4	.9	.4	.3	.25
9	1.6	1.0	2.2	.3	1.0	.4	.3	.25
10	2.0	1.0	2.5	.3	1.7	.4	.3	.25
11	2.6	1.0	2.6	.3	1.8	.4	.3	.2
12	3.0	.9	1.6	.3	1.7	.4	.3	.2
13	2.6	.9	1.0	.3	1.0	.5	.3	.2
14	1.9	.8	.8	.3	.7	.5	.3	.2
15	3.8	.8	.7	.4	.5	.6	.3	.2
16	3.9	.8	.7	.4	.5	.8	.3	.2
17	2.9	.7	.6	.5	.5	.6	.3	.2
18	1.1	.6	.8	.6	.4	.6	.3	.2
19	2.9	.6	1.1	.5	.4	.4	.3	.2
20	2.8	.6	1.7	.4	.4	.4	.3	.2
21	2.8	.5	1.0	.4	.5	.4	.3	.2
22	2.7	.5	.8	.4	4.1	.4	.3	.2
23	2.6	.4	.7	.4	4.4	.4	.3	.2
24	1.3	.5	.6	.4	4.5	.3	.3	.2
25	.9	.6	.6	.3	4.4	.3	.3	.2
26	.5	4.6	.5	.3	4.3	.3	.3	.2
27	.5	5.9	.6	.3	4.2	.3	.3	.2
28	.5	6.2	.5	.25	4.1	.3	.3	.2
29	.5	6.8	.5	.2	3.5	.3	.3	.2
30	.5	3.0	.5	.2	3.3	.3	.3	.2
31	.....	2.8	.....	.2	3.2	.....	.3	.....

Rating table for Little Missouri River at Camp Crook, S. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet*	*Sec.-ft*
0.20	6	1.20	187	2.20	548	3.40	1,108
.30	13	1.30	218	2.30	590	3.60	1,212
.40	22	1.40	250	2.40	633	3.80	1,317
.50	34	1.50	284	2.50	677	4.00	1,424
.60	48	1.60	319	2.60	722	4.20	1,533
.70	65	1.70	355	2.70	768	4.40	1,644
.80	85	1.80	392	2.80	815	4.60	1,756
.90	107	1.90	430	2.90	862	4.80	1,868
1.00	131	2.00	468	3.00	910		
1.10	158	2.10	507	3.20	1,007		

NOTE.—The above table is applicable only for open-channel conditions. It is based on five discharge measurements made during 1906 and is fairly well defined. Above gage height 4.3 the rating curve is a tangent, the difference being 56 per tenth.

Monthly discharge of Little Missouri River at Camp Crook, S. Dak., for 1906.

[Drainage area, 1,900 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	1,370	34	546	32,500	0.287	0.32
May	2,990	22	611	37,600	.322	.37
June	1,920	34	288	17,100	.152	.17
July	34	6	19.8	1,220	.010	.01
August	1,700	6	537	33,000	.283	.33
September	910	13	124	7,380	.065	.07
October	13	13	13.0	799	.0068	.008
November	13	6	7.6	452	.0040	.004
The period				130,000		

NOTE.—Values are rated as follows: April to June, August, and September, good; July, fair; October and November, approximate.

LITTLE MISSOURI RIVER AT MEDORA, N. DAK.

This station was established May 12, 1903. It is located at the Northern Pacific Railway bridge, one-third mile west of the railroad station at Medora, N. Dak. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 125, where are given also references to publications that contain data for previous years.

Discharge measurements of Little Missouri River at Medora, N. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 11	E. F. Chandler	89	269	4.77	584
August 29	do	196	733	7.54	3,290
August 30	do	189	542	6.59	2,030
August 31	do	161	412	6.01	1,230
October 12	R. Richards	[a] 38	[a] 22	3.33	[illegible]

[a] Wading section.

Daily gage height, in feet, of Little Missouri River at Medora, N. Dak., for 1906.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	6.2	8.0	4.0	7.5	4.3	3.5	5.6	3.45	3.3
2	.....	5.0	6.8	4.2	7.0	4.3	3.5	5.2	3.45	3.4
3	.....	4.2	6.2	4.3	5.7	4.2	6.4	5.0	3.4	3.4
4	.....	4.0	6.6	4.3	5.7	4.3	5.0	4.8	3.4	3.4
5	.....	4.0	6.2	4.2	6.0	4.2	5.1	4.6	3.4	3.4
6	.....	4.0	5.7	4.1	7.4	4.1	5.0	4.4	3.3	3.4
7	.....	7.5	5.3	4.6	7.0	4.0	5.1	4.3	3.3	3.4
8	.....	5.6	5.1	6.0	12.0	4.0	5.0	4.2	3.3	3.4
9	.....	5.0	5.0	5.8	10.4	3.9	4.9	4.0	3.2	3.4
10	.....	4.2	5.0	5.4	9.7	3.9	4.8	3.9	3.2	3.4
11	.....	4.0	4.9	5.0	8.7	3.8	4.5	3.8	3.2	3.4
12	.....	4.0	5.3	4.8	7.0	3.7	4.4	3.7	3.2	3.4
13	.....	4.0	6.1	4.9	6.6	3.7	4.2	3.6	3.2	3.4
14	.....	4.0	5.5	5.0	5.7	3.7	4.0	5.0	3.2	3.4
15	.....	4.0	5.0	5.7	5.5	3.7	3.8	6.2	3.2	3.4
16	.....	4.0	4.8	5.6	5.2	3.7	3.7	6.0	3.2	3.4
17	2.8	4.0	4.5	5.5	5.2	3.7	3.6	5.7	3.2	3.4
18	3.0	4.0	6.0	5.0	5.2	3.6	3.6	5.3	3.2	.....
19	3.2	7.6	5.6	4.8	5.1	3.6	3.6	4.8	3.2	.....
20	3.4	7.0	5.0	4.6	4.8	3.6	3.7	4.3	3.2	.....
21	3.8	7.0	4.7	4.5	4.7	3.6	3.8	4.0	3.2	.....
22	4.0	7.0	4.3	4.4	4.6	3.6	3.9	3.7	3.2	.....
23	4.6	7.0	4.2	4.6	4.7	3.6	4.0	3.6	3.2	.....
24	4.0	7.6	4.0	4.7	4.7	3.5	4.2	3.6	3.2	.....
25	3.6	6.0	3.9	5.0	4.7	3.5	4.8	3.6	3.2	.....
26	4.9	5.8	3.9	5.8	4.6	3.5	6.0	3.5	3.3	.....
27	4.0	6.0	3.8	7.0	4.5	3.5	8.3	3.5	3.3	.....
28	4.0	5.8	3.8	5.9	4.4	3.6	8.0	3.5	3.3	.....
29	.....	5.0	3.7	6.6	4.5	3.6	7.4	3.45	3.3	.....
30	.....	4.6	3.8	8.1	4.3	3.5	6.8	3.45	3.3	.....
31	.....	10.0	.....	8.2	.....	3.5	6.0	.....	3.3	.....

NOTE.—Ice conditions January 1 to March 22; also November 18 to December 31.

Rating table for Little Missouri River at Medora, N. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.20	15	4.40	418	5.60	1,060	7.60	3,280
3.30	29	4.50	460	5.70	1,135	7.80	3,580
3.40	54	4.60	503	5.80	1,215	8.00	3,890
3.50	85	4.70	547	5.90	1,295	8.20	4,210
3.60	118	4.80	592	6.00	1,380	8.40	4,530
3.70	152	4.90	639	6.20	1,565	8.60	4,850
3.80	187	5.00	688	6.40	1,770	8.80	5,170
3.90	223	5.10	740	6.60	1,990	9.00	5,500
4.00	260	5.20	795	6.80	2,220	10.00	7,200
4.10	298	5.30	855	7.00	2,470	11.00	8,900
4.20	337	5.40	920	7.20	2,730	12.00	10,600
4.30	377	5.50	990	7.40	3,000		

NOTE.—The above table is applicable only for open-channel conditions. It is based on fifteen discharge measurements made during 1905–6 and is well defined up to 9 feet gage height.

Monthly discharge of Little Missouri River at Medora, N. Dak., for 1906.

[Drainage area, 5,780 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March (23–31)	7,200	503	2,150	38,400	0.372	0.12
April	3,890	152	894	53,200	.155	.17
May	4,210	260	1,010	62,100	.175	.20
June	10,600	377	2,000	119,000	.346	.39
July	377	85	181	11,100	.031	.04
August	4,370	85	867	53,300	.150	.17
September	1,560	69	449	26,700	.078	.09
October	69	15	26.3	1,620	.0046	.01
November (1–17)	54	29	52.5	1,770	.0091	.01
The period	.....	.....	.....	367,000	.....	.....

NOTE.—Values are rated as follows: March to September, probably good; October, approximate on account of low stage and erroneous gage heights; November, fair.

KNIFE RIVER DRAINAGE BASIN.

KNIFE RIVER AT BRONCHO, N. DAK.

This station was established May 29, 1903. Its first location was at a point about 600 feet east of H. M. Haven's ranch house, where the Broncho post-office was situated at that time, and about 23 miles north of Hebron, N. Dak., on the Northern Pacific Railway. Owing to the abandonment of the Haven ranch and the removal of the post-office to the house of F. M. Smith, in the SE. ¼ sec. 4, T. 142, R. 90 W., about 3 miles up the valley, the location was abandoned and a new station was established at the ranch of Mr. Smith on March 23, 1905. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 128, where are given also references to publications that contain data for previous years. The data collected are valuable for irrigation purposes.

Discharge measurements of Knife River at Broncho, N. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 12	E. F. Chandler	34	97	4.08	35.4
April 12	do	13	11	4.08	39.0
August 27	do	[b] 17	[b] 28	3.87	13.5

[a] Made 3 miles above gage. [b] Wading section.

Daily gage height, in feet, of Knife River at Broncho, N. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		9.55	3.55	11.25	11.95	3.75	3.85	3.6	3.6
2		8.2	3.55	9.05	6.15	3.8	3.8	3.6	3.6
3		6.7	3.55	6.15	4.95	3.85	3.8	3.55	3.6
4		5.55	3.55	4.95	4.65	3.85	3.8	3.5	3.6
5		5.25	3.5	4.65	4.45	3.95	3.8	3.5	3.6
6		4.85	3.55	7.75	4.4	3.9	3.75	3.55	3.6
7		4.35	3.55	9.0	4.3	3.85	3.75	3.6	3.6
8		4.45	3.55	11.65	4.15	3.95	3.7	3.6	3.6
9		4.35	3.45	13.6	4.15	4.05	3.7	3.6	3.6
10		4.25	3.45	14.45	4.15	4.0	3.7	3.6	3.6
11		4.15	3.45	13.9	4.15	3.95	3.7	3.6	3.6
12		4.05	3.45	11.3	4.05	3.95	3.75	3.6	3.6
13		3.95	3.45	6.75	4.05	3.85	3.7	3.6	3.6
14		3.95	3.65	6.15	3.95	3.85	3.7	3.6	3.6
15		3.85	5.55	5.2	4.05	3.85	3.7	3.6	3.6
16		3.85	5.75	4.75	4.05	3.9	3.7	3.6	[illegible]
17		3.75	4.85	6.75	4.05	3.95	3.7	3.6	...
18		3.75	5.85	10.5	4.0	3.9	3.7	3.6	...
19		3.7	5.85	9.0	3.95	3.85	3.7	3.6	...
20		3.65	4.7	6.95	3.95	3.9	3.7	3.6	...
21		3.65	4.65	5.45	3.95	3.95	3.7	3.6	...
22		3.65	4.4	4.65	3.85	3.95	3.7	3.6	...
23		3.6	4.25	4.45	3.95	3.9	3.7	3.6	...
24		3.55	4.15	4.35	3.95	3.85	3.7	3.6	...
25		3.55	7.5	4.25	3.9	3.85	3.65	3.6	...
26		3.55	14.05	4.25	3.85	3.85	3.6	3.6	...
27	5.95	3.55	14.4	4.2	3.75	3.85	3.6	3.6	...
28	7.0	3.55	10.15	4.15	3.85	3.9	3.6	3.6	...
29	8.1	3.55	7.7	7.85	3.75	3.9	3.6	3.6	...
30	9.75	3.55	9.95	12.9	3.75	3.9	3.6	3.6	...
31	9.55	.....	13.25	.....	3.75	3.85	.....	3.6	...

NOTE.—Ice conditions January 1 to March 26, also November 17 to December 31.

HEART RIVER DRAINAGE BASIN.

HEART RIVER NEAR RICHARDTON, N. DAK.

This station was established May 18, 1903. It is located at the iron highway bridge 10 miles south of the Northern Pacific Railway station at Richardton, N. Dak. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 130, where are given also references to publications that contain data for previous years. The data collected at this station are valuable for irrigation purposes.

Discharge measurements of Heart River near Richardton, N. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 11	E. F. Chandler	64	61	5.05	38.4
August 29	do	[a] 18	[a] 12	4.50	18.2

[a] Wading section.

Daily gage height, in feet, of Heart River, near Richardton, N. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	8.8	4.4	14.45	4.6	4.5	4.5	4.2	4.3
2	.....	7.7	4.4	10.55	4.7	4.4	4.5	4.2	4.3
3	.....	7.0	4.4	8.3	4.6	4.8	4.5	4.2	4.3
4	.....	6.7	4.4	6.9	4.7	4.7	4.5	4.2	4.3
5	6.3	6.2	4.4	6.4	4.6	4.7	4.4	4.2	4.3
6	6.1	5.7	4.4	6.0	4.7	4.6	4.4	4.2	4.3
7	6.0	5.5	4.4	7.7	4.6	4.7	4.4	4.2	4.3
8	5.9	5.5	4.4	16.4	4.7	4.5	4.3	4.2	4.3
9	5.7	5.4	4.4	21.0	4.7	4.6	4.3	4.2	4.3
10	5.6	5.3	4.4	25.9	4.8	4.5	4.3	4.2	4.3
11	.....	5.1	4.4	19.6	4.7	4.6	4.3	4.2	4.3
12	.....	5.1	4.4	11.4	4.8	4.5	4.3	4.2	4.3
13	.....	5.0	4.5	8.9	4.7	4.6	4.3	4.2	4.4
14	.....	5.0	4.6	8.5	4.8	4.5	4.3	4.2	4.4
15	.....	4.9	4.9	8.4	4.7	4.6	4.3	4.2	4.4
16	.....	4.8	5.2	8.1	4.8	4.5	4.3	4.2	4.4
17	.....	4.8	5.1	7.7	4.7	4.6	4.3	4.2	.....
18	.....	4.7	5.3	7.2	4.8	4.5	4.3	4.2	.....
19	.....	4.7	5.1	6.6	4.7	4.6	4.3	4.2	.....
20	.....	4.7	5.2	6.3	4.7	4.5	4.3	4.2	.....
21	.....	4.7	5.4	5.9	4.6	4.6	4.3	4.2	.....
22	.....	4.6	5.2	5.9	4.7	4.5	4.3	4.2	.....
23	.....	4.6	5.1	5.7	4.6	4.6	4.3	4.2	.....
24	.....	4.6	5.2	5.6	4.7	4.5	4.3	4.2	.....
25	.....	4.5	6.05	5.3	4.5	4.6	4.2	4.2	.....
26	6.9	4.5	9.8	5.2	4.6	4.5	4.2	4.2	.....
27	7.1	4.4	12.4	4.9	4.4	4.6	4.2	4.2	.....
28	7.2	4.4	11.75	4.9	4.5	4.5	4.2	4.2	.....
29	7.3	4.4	9.15	4.7	4.4	4.5	4.2	4.3	.....
30	9.25	4.4	9.4	4.7	4.5	4.5	4.2	4.3	.....
31	9.3	.....	12.75	.....	4.4	4.5	.....	4.3	.....

NOTE.—Ice conditions January 1 to March 25 and November 17 to December 31. Ice thickness increased from 2 feet January 25 to 2.6 feet February 28.

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous discharge measurements of Heart River have been made at Mandan, N. Dak.:

Miscellaneous discharge measurements of Heart River at Mandan, N. Dak.

	Discharge in sec.-ft.
1904.	
August 3	23
September 28	11
October 26	13
1905.	
March 26	69
July 1	110
August 3	96
October 15	12
1906.	
April 8	416
August 26	59
September 13	34

CANNON BALL RIVER DRAINAGE BASIN.

CANNON BALL RIVER AT STEVENSON, N. DAK.

This station was established June 10, 1903. It is located one-half mile west northwest of the post-office at Stevenson, in sec. 20, T. 133 N., R. 82 W., and about 40 miles south of Mandan, N. Dak.

The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 134, where are given also references to publications that contain data for previous years. The length of the chain is now 21.43 feet. The data collected are valuable for irrigation purposes.

Discharge measurements of Cannon Ball River at Stevenson, N. Dak., 1903–1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1903.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 10	F. E. Weymouth	64	89	3.10	75
July 10	E. F. Chandler	20	23	2.62	11.4
July 11	F. E. Weymouth	22	26	2.63	12.0
July 23	E. F. Chandler	30	43	3.10	56
July 24	do	19	26	2.83	19.4
July 26	do		13	2.71	7.5
October 23	do		102	3.10	[a] 35
1904.					
April 10	E. F. Chandler	158	686	7.18	2,370
July 4	Chandler and Richards	104	156	3.24	72
August 1	E. F. Chandler	37	30	2.65	6.0
August 1	R. Richards	34	21	2.64	5.2
October 25	L. L. Wilcox	7	3.8	2.58	3.5
1905.					
March 28	E. F. Chandler	114	168	3.56	99
June 29	do	40	56	3.45	123
June 30	do	68	132	3.49	114
August 3	R. Richards	68	120	3.52	102
August 28	do	38	32	2.88	20
August 29	do	34	21	2.85	19
October 17	E. F. Chandler	14	10	2.61	4.8
1906.					
April 9	E. F. Chandler	110	288	4.48	393
August 23	do	40	43	3.14	49.6
August 24	do	39	41	3.09	42.2
September 14	do	36	37	2.92	26.6

[a] Meter in poor adjustment.

NOTE.—The low-water measurements were made at different sections.

Daily gage height, in feet, of Cannon Ball River at Stevenson, N. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	8.7	3.3	6.0	2.9	3.3	2.9	3.2	1.8
2	.....	7.7	3.3	5.6	2.6	3.5	3.3	3.2	1.8
3	.....	9.2	3.2	5.9	2.7	3.6	3.3	3.2	1.9
4	.....	5.6	3.1	6.6	2.5	3.6	3.2	3.0	1.8
5	.....	4.9	3.1	8.3	2.5	3.5	3.2	3.0	1.8
6	.....	4.6	3.0	10.2	2.3	3.3	3.1	2.9	1.9
7	.....	4.6	3.0	10.5	2.3	3.3	3.0	2.9	1.9
8	.....	4.6	2.9	9.7	2.7	3.1	2.9	2.8	1.9
9	.....	4.6	3.0	9.2	2.7	2.9	2.9	2.8	1.8
10	.....	4.65	3.1	8.9	2.5	2.9	3.0	2.8	1.8
11	.....	4.4	3.2	8.9	2.4	2.9	3.0	2.7	3.0
12	.....	4.0	3.2	9.9	2.6	2.9	3.2	2.7	3.0
13	.....	3.9	3.2	9.7	2.6	2.7	3.3	2.7	1.9
14	.....	3.85	3.4	9.1	2.5	2.7	3.2	2.7	1.9
15	.....	3.8	4.0	8.2	3.7	2.6	3.2	2.6	1.9
16	.....	3.75	4.5	7.3	3.7	2.6	3.1	2.6	1.9
17	.....	3.8	4.9	6.7	3.8	2.6	3.0	2.4	3.0
18	.....	3.6	4.9	6.7	3.7	2.6	3.0	2.4	3.2
19	6.5	3.6	5.0	6.2	3.5	3.2	3.1	2.2	3.2
20	.....	3.55	5.0	5.7	3.5	3.2	3.1	2.2	2.9
21	.....	3.4	5.0	5.3	3.5	3.0	3.0	2.1	2.9
22	.....	3.4	4.9	5.2	3.4	3.0	3.0	2.0	2.8
23	.....	3.4	4.3	5.2	3.4	3.1	2.8	2.1	2.9
24	.....	3.2	5.4	4.6	3.3	3.1	2.8	2.1	2.9
25	.....	3.2	6.3	4.2	3.3	3.1	2.7	2.0	.....
26	.....	3.15	6.4	4.2	3.2	3.2	2.7	2.0	.....
27	.....	3.1	7.3	3.9	3.1	3.3	2.9	1.9	.....
28	.....	3.2	7.6	3.9	3.0	3.2	2.9	1.9	.....
29	8.2	3.3	7.2	3.6	3.0	3.0	3.0	1.8	.....
30	.....	3.4	6.6	3.2	3.1	3.0	.....	1.8	.....
31	.....	.....	6.1	.....	3.1	2.9	.....	1.8	.....

NOTE.—Ice conditions, January 1 to March 31; thickness of ice increased from 0.7 foot, January 1, to 3.1 feet, March 8. Ice conditions, November 18 to December 31.

Rating tables for Cannon Ball River at Stevenson, N. Dak.

JUNE 10, 1903, TO JULY 15, 1904.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.20	3	2.70	14	3.20	63	3.70	153
2.30	4	2.80	20	3.30	77	3.80	178
2.40	6	2.90	28	3.40	92	3.90	206
2.50	8	3.00	38	3.50	110	4.00	236
2.60	11	3.10	50	3.60	130		

JULY 16, 1904, TO NOVEMBER 24, 1906.[b]

2.00	0	3.20	55	4.40	364	6.20	1,480
2.10	.5	3.30	69	4.50	400	6.40	1,660
2.20	1	3.40	86	4.60	440	6.60	1,840
2.30	2	3.50	106	4.70	485	6.80	2,020
2.40	3	3.60	128	4.80	530	7.00	2,200
2.50	4	3.70	152	4.90	580	7.20	2,400
2.60	5	3.80	178	5.00	635	7.40	2,600
2.70	9	3.90	206	5.20	750	7.60	2,800
2.80	16	4.00	236	5.40	870	7.80	3,000
2.90	24	4.10	266	5.60	1,010	8.00	3,200
3.00	33	4.20	298	5.80	1,150	9.00	4,250
3.10	43	4.30	330	6.00	1,310	10.00	5,350

[a] This table is applicable only for open-channel conditions. It is based on seven discharge measurements made during 1903 and is not well defined. Above 4 feet use the 1904–6 rating table.

[b] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–6 and is fairly well defined between gage heights 2.6 feet and 4.5 feet. Above 4.5 feet the rating curve is based on one measurement at 7.2 feet gage height.

Monthly discharge of Cannon Ball River at Stevenson, N. Dak., for 1903–1906.

[Drainage area, 3,650 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
1903.						
June 10–30	62	14	33.2	1,380	0.0091	0.01
July	104	4	25.0	1,540	.0068	.10
August	1,930	12	331	20,400	.091	.01
September	1,010	4	189	11,200	.052	.06
October	50	9	21.5	1,320	.0059	.01
November 1–21	92	9	29.5	1,230	.0081	.01
The period				37,100		
1904.						
April 6–30	3,000	153	849	42,100	.233	.22
May	153	38	84.5	5,200	.023	.03
June	1,930	50	552	32,800	.151	.17
July	130	5	36.4	2,240	.010	.01
August	24	0	4.7	289	.0013	.002
September	9	0	3.4	202	.00093	.001
October	80	1.1	15.2	935	.0042	.005
November 1–29	24	3.0	11.0	633	.0030	.003
The period				84,400		
1905. [a]						
March	2,600	80	584	35,900	.160	.18
April	152	5	46.9	2,790	.013	.01
May	1,080	4	231	14,200	.063	.07
June	2,300	3	324	19,300	.089	.10
July	810	10	304	18,700	.083	.10
August	230	3	75.0	4,610	.021	.02
September	24	0	6.1	363	.0017	.002
October	24	0	6.9	424	.0019	.002
November 1–25	55	9	27.8	1,380	.0076	.007
The period				97,700		
1906. [b]						
April 3–30	1,010	43	236	12,600	.065	.07
May	2,800	24	656	40,300	.180	.21
June	5,900	55	2,300	137,000	.630	.703
July	178	2	51.6	3,170	.014	.02
August	128	5	46.0	2,830	.013	.02
September	69	9	37.7	2,240	.010	.01
October	55	0	12.3	756	.0034	.004
November 1–24	55	0	13.4	638	.0037	.003
The period				200,000		

[a] Values are rated as follows: March and May to August, good; April and September to November, fair.

[b] Values are rated as follows: April to August, good; September to November, fair.

GRAND RIVER DRAINAGE BASIN.

GRAND RIVER AT SEIM, S. DAK.

This station was established June 6, 1904. It is located just below the junction of North and South forks, about 800 feet east of the store at Seim. The gage was read during 1906 by Charles S. Wilson. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 135, where are given also references to publications that contain data for previous years. The data collected are valuable for irrigation purposes.

Discharge measurements of Grand River at Seim, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 22	J. E. Stewart	40	55	1.86	20
June 17	do	53	47	2.40	109
June 18	do		670	6.67	2,910
June 18	do		556	6.08	2,290
June 18	do		363	4.88	1,350

NOTE.—These measurements were made at different sections.

Daily gage height, in feet, of Grand River at Seim, S. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1		3.6	2.1	4.8	3.1	1.0	1.4	1.6
2		3.4	2.0	5.6	3.0	1.2	1.5	1.6
3		3.4	2.0	5.4	2.8	1.2	1.7	1.5
4		3.3	2.3	5.4	2.4	1.3	1.7	1.8
5		3.6	2.5	6.3	2.3	1.5	1.6	1.8
6		3.4	2.3	6.6	2.1	2.1	1.5	1.7
7	4.8	3.2	2.4	7.0	2.1	2.3	1.5	1.6
8	6.2	3.3	2.4	6.3	2.0	2.3	1.6	1.7
9	6.3	3.3	2.3	6.1	2.0	2.4	1.5	1.9
10	6.6	3.4	2.2	5.8	2.2	2.6	1.8	1.8
11		3.0	2.2	5.4	2.0	3.0	1.4	
12		3.2	2.1	5.6	1.8	2.8	1.7	
13		3.1	2.1	5.8	2.0	2.7	1.8	
14		3.1	2.0	6.2	2.0	2.4	1.8	
15		3.0	2.1	5.2	1.7	2.2	1.7	
16		3.1	2.1	2.4	1.8	2.1	1.6	
17		3.2	2.1	2.4	1.6	1.8	1.7	
18		3.1	2.0	5.9	1.8	1.6	1.9	
19		2.0	2.0	4.0	1.9	1.6	1.9	
20		1.8	2.0	5.6	1.6	1.8	1.6	
21		1.8	2.0	4.2	1.5	1.1	1.7	
22		1.9	2.0	3.4	1.5	1.9	1.8	
23		1.9	2.1	3.3	1.3	1.8	1.8	
24		2.0	3.1	3.8	1.3	1.1	1.7	
25		2.3	3.4	3.2	1.3	1.9	1.6	
26	5.8	2.4	4.1	3.0	1.2	1.6	1.8	
27	6.3	2.5	5.0	2.8	1.2	1.7	1.8	
28	5.2	2.5	5.0	2.6	1.2	1.8	1.8	
29	5.1	2.3	5.2	2.5	1.0	1.6	1.6	
30	4.6	2.0	5.3	2.3	1.0	1.5	1.4	
31	4.2		5.2		1.0	1.5		

Rating table for Grand River at Seim, S. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	0	2.60	156	3.80	620	5.00	1,440
1.50	1	2.70	182	3.90	681	5.20	1,587
1.60	3	2.80	210	4.00	745	5.40	1,735
1.70	7	2.90	239	4.10	810	5.60	1,887
1.80	16	3.00	270	4.20	876	5.80	2,046
1.90	26	3.10	304	4.30	944	6.00	2,210
2.00	38	3.20	340	4.40	1,013	6.20	2,380
2.10	53	3.30	379	4.50	1,084	6.40	2,550
2.20	70	3.40	420	4.60	1,155	6.60	2,720
2.30	89	3.50	466	4.70	1,226	6.80	2,890
2.40	110	3.60	514	4.80	1,297	7.00	3,060
2.50	132	3.70	565	4.90	1,368		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–6, and is well defined between gage heights 1.8 feet and 7 feet.

Monthly discharge of Grand River at Seim, S. Dak., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
March (7-10; 26-31)	2,720	876	1,850	36,700
April	514	16	246	14,600
May	1,660	38	345	21,200
June	3,060	89	1,330	79,100
July	304	0	46.4	2,850
August	270	0	49.4	3,040
September	26	0	8.4	500
October (1-10)	26	1	9.8	194
The period				158,000

NOTE.—Values are somewhat uncertain, owing to approximate gage heights.

OWL RIVER DRAINAGE BASIN.[a]

OWL RIVER AT BIXBY, S. DAK.

This station was established June 4, 1904. It is located one-fourth mile southeast of Bixby, S. Dak., in T. 14 N., R. 13 E., about 1,000 feet below the ford. The gage was read during 1906 by John Beam. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 137, where are given also references to publications that contain data for previous years.

Discharge measurements of Owl River at Bixby, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 21	J. E. Stewart	26.6	15	1.41	9.7
June 19	do	108	512	6.65	2,320
June 20	do	89	304	4.45	1,040
June 20	do	86	273	4.09	807
June 20	do	83	219	3.47	550

Daily gage height, in feet, of Owl River at Bixby, S. Dak., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		2.5	4.6	1.7	1.3	1.3	1.2	1.2
2		3.3	4.1	1.6	1.2	1.3	1.2	1.2
3		4.1	3.5	1.6	1.2	1.3	1.2	1.2
4		3.5	2.8	1.6	1.2	1.3	1.2	1.2
5		3.1	2.4	1.5	1.2	1.3	1.2	1.2
6		2.8	3.1	1.5	1.2	1.3	1.2	1.3
7		2.4	2.7	1.5	1.2	1.3	1.2	1.3
8		2.1	2.8	1.4	1.2	1.3	1.2	1.4
9		1.7	2.8	1.4	1.2	1.3	1.2	1.4
10		1.4	3.4	1.4	1.2	1.3	1.2	1.3
11		1.4	3.2	1.4	1.4	1.3	1.2	1.3
12		1.3	3.2	1.4	1.4	1.3	1.2	1.3
13		1.3	2.8	1.3	1.3	1.3	1.2	1.3
14		1.8	2.6	1.3	1.3	1.3	1.2	1.3
15		2.1	2.2	1.4	1.2	1.4	1.2	1.3
16		2.1	1.6	1.4	1.2	1.5	1.2	1.2
17		2.4	1.5	1.3	1.2	1.5	1.2	1.4

[a] Called Moreau River in previous reports, but correct name decided to be Owl, by United States Board on Geographic Names.

Daily gage height, in feet, of Owl River at Bixby, S. Dak., for 1906—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
18		2.4	5.8	1.3	1.2	1.5	1.2	1.4
19		2.2	7.4	1.2	1.2	1.5	1.2	1.4
20		2.1	4.05	1.2	1.2	1.4	1.2	1.4
21		1.8	2.55	1.2	1.3	1.4	1.2	1.5
22	1.45	1.6	2.2	1.1	1.3	1.2	1.2	1.5
23	1.4	1.9	2.1	1.1	1.3	1.2	1.2	1.5
24	1.4	4.2	2.0	1.1	1.3	1.2	1.2	1.5
25	1.4	4.2	1.8	1.2	1.3	1.2	1.2	1.5
26	1.35	5.6	1.8	1.2	1.3	1.1	1.2	1.5
27	1.3	5.6	1.7	1.3	1.4	1.1	1.2	1.5
28	1.3	5.2	1.7	1.2	1.4	1.1	1.2	1.5
29	1.3	4.8	1.7	1.2	1.3	1.2	1.2	1.5
30	1.3	5.6	1.6	1.3	1.3	1.2	1.2	1.5
31		4.8		1.3	1.3		1.2	

Rating table for Owl River at Bixby, S. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	0	2.10	111	3.00	365	3.90	743
1.30	3	2.20	133	3.10	402	4.00	791
1.40	9	2.30	156	3.20	440	4.10	843
1.50	16	2.40	180	3.30	479	4.20	898
1.60	26	2.50	205	3.40	519	4.30	954
1.70	38	2.60	233	3.50	561	4.40	1,012
1.80	53	2.70	263	3.60	605	4.50	1,070
1.90	70	2.80	295	3.70	650	4.60	1,128
2.00	90	2.90	329	3.80	696		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906 and is well defined between gage heights 1.35 feet and 7 feet. Above gage height 4.3 feet the rating curve is a tangent, the difference being 58 per tenth.

Monthly discharge of Owl River at Bixby, S. Dak., for 1906.

[Drainage area, 1,600 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April (22–30)	12	3	6.3	112	0.0039	0.001
May	1,710	3	485	29,800	.303	.35
June	2,750	16	418	24,900	.261	.29
July	38	0	8.0	492	.0050	.006
August	9	0	2.3	141	.0014	.002
September	16	0	4.4	262	.0028	.003
October	0	0	0	0	.0000	.000
November	16	0	7.9	470	.0049	.005
The period				56,200		

NOTE.—Values are rated as follows: May and June, excellent; April and July to November, approximate.

CHEYENNE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Cheyenne River rises in the eastern part of Wyoming, flows eastward around the southern border of the Black Hills, turns to the northeast, and unites with the Missouri in the central part of South Dakota.

It drains a long narrow valley bordered by high table-lands and occasional low flats containing a few thousand acres each.

The principal tributaries are Beaver and Hat creeks, Fall River, Battle, Spring, Rapid, and Boxelder creeks, Belle Fourche River, and Sulphur Creek. The chief tributaries of the Belle Fourche are Redwater River and Whitewood Creek; Redwater River has one large tributary, Spearfish Creek.

The rainfall varies from 21 inches in the Black Hills region to 12 inches on the prairies. The main floods occur in March, May, June, and July. Many of the streams rising in the Black Hills are fed to a large extent by springs. Fall River, in particular, gets much of its water from hot springs and mineral springs.

The data collected in this basin are valuable for irrigation purposes.

CHEYENNE RIVER AT EDGEMONT, S. DAK.

This station was established June 19, 1903. It is located at the railway bridge, in the SE. ¼ sec. 36, T. 8 S., R. 2 E., 300 feet above the mouth of Cottonwood Creek.

The conditions[a] at this station and the bench marks are described in Water-Supply Paper No. 172, page 141, where are given also references to publications that contain data for previous years.

Discharge measurements of Cheyenne River at Edgemont, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 29	Comstock and Stewart	244	543	4.01	1,670
May 5	J. E. Stewart	214	261	3.11	555
May 28	do	230	588	4.43	1,920
May 29	do	237	706	5.14	2,440
May 31	do	203	357	3.57	927
September 5	do	[a] 30	[a] 17.3	1.72	25

[a] Wading section.

Daily gage height, in feet, of Cheyenne River at Edgemont, S. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		2.5	2.9	3.2	2.0	1.4	1.7	1.6	1.7
2		2.5	2.2	3.1	1.8	1.4	1.7	1.6	1.7
3		2.5	3.9	2.9	1.7	1.4	1.6	1.6	1.6
4		2.5	3.2	2.3	1.6	1.4	1.5	1.5	1.5
5		2.5	3.1	2.3	1.6	1.4	1.7	1.5	1.5
6		2.5	2.8	3.2	1.5	3.5	1.7	1.5	1.5
7		2.5	2.6	3.3	1.5	5.1	1.7	1.5	1.5
8		2.2	2.3	3.5	1.5	3.4	1.7	1.5	1.5
9		2.2	2.2	3.0	1.4	2.8	1.7	1.5	1.5
10		2.2	2.0	3.0	1.4	2.8	1.7	1.3	1.5
11	3.2	2.2	1.8	3.4	1.4	1.8	1.7	1.3	1.5
12	3.2	2.2	1.8	4.3	2.3	1.8	1.7	1.3	1.5
13	3.2	2.2	1.7	3.0	2.3	1.5	1.7	1.3	1.5
14	3.2	2.2	1.6	2.5	2.3	1.5	2.0	1.3	1.5
15	3.2	2.2	1.6	2.4	2.0	1.5	2.0	1.3	1.5

[a] New chain gage installed May 5, 1906; length of chain, 27.61 feet.

Daily gage height, in feet, of Cheyenne River at Edgemont, S. Dak., for 1906—Cont'd.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
16	3.2	2.2	1.6	2.4	2.0	1.5	2.6	1.3	1.5
17	3.2	2.9	1.6	2.1	2.0	1.5	3.0	1.4	1.5
18	3.2	2.9	1.6	2.0	2.0	1.5	6.7	1.4	1.6
19	3.2	2.2	1.6	2.1	1.9	1.5	6.0	1.4	1.6
20	3.2	1.6	1.5	2.0	1.8	6.7	2.8	1.4	1.6
21	3.2	1.6	1.5	1.9	1.7	3.0	2.0	1.4	1.6
22	3.3	1.6	1.5	1.7	1.6	3.0	2.0	1.4	1.6
23	3.3	1.6	2.7	1.8	1.5	4.8	1.8	1.4	1.6
24	3.3	1.6	3.0	2.0	1.5	3.1	1.6	1.4	1.6
25	1.4	1.7	3.0	1.9	1.5	3.1	1.6	1.4	1.6
26	2.0	1.7	4.65	2.1	1.5	2.5	1.7	1.4	1.6
27	7.0	1.7	6.0	2.0	1.5	2.0	2.0	1.4	1.6
28	6.2	1.7	4.4	2.4	1.5	2.0	2.0	1.4	1.6
29	3.4	1.7	5.1	2.3	1.5	1.9	1.7	1.4	1.6
30	2.9	2.9	4.5	2.1	1.4	1.9	1.7	1.4	1.6
31	2.8	.....	3.75	.....	1.4	1.7	.....	1.4	.....

NOTE.—Ice conditions March 11–24; gage heights were to the top of ice. March 25 and 26 the gage height was uncertain.

Rating table for Cheyenne River at Edgemont, S. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	2	2.50	225	3.70	1,048	4.90	2,341
1.40	5	2.60	275	3.80	1,140	5.00	2,460
1.50	9	2.70	328	3.90	1,234	5.20	2,706
1.60	15	2.80	383	4.00	1,330	5.40	2,965
1.70	23	2.90	440	4.10	1,430	5.60	3,237
1.80	34	3.00	500	4.20	1,534	5.80	3,516
1.90	49	3.10	562	4.30	1,642	6.00	3,800
2.00	67	3.20	632	4.40	1,754	6.20	4,087
2.10	87	3.30	706	4.50	1,870	6.40	4,375
2.20	110	3.40	784	4.60	1,987	6.60	4,667
2.30	141	3.50	870	4.70	2,105	6.80	4,965
2.40	180	3.60	958	4.80	2,223		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1906 and the form of previous measurements, and is not very well defined. From March 27 to April 19 the table was applied indirectly.

Monthly discharge of Cheyenne River at Edgemont, S. Dak., for 1906.

[Drainage area, 7,350 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March (27–31)	6,000	550	2,550	25,300	0.347	0.06
April	530	23	204	12,100	.028	.03
May	3,800	9	601	37,000	.082	.09
June	1,640	23	325	19,300	.044	.05
July	141	5	34.9	2,150	.0047	.005
August	4,820	5	477	29,300	.065	.07
September	4,820	9	353	21,000	.048	.05
October	15	2	5.8	357	.00079	.001
November	23	5	8.4	500	.0011	.001
The period	.....	.....	.....	147,000	.....	.....

NOTE.—Values are rated as follows: March and April, approximate; May, good; June to November, approximate on account of the changing conditions of flow at this station.

BEAVER CREEK NEAR EDGEMONT, S. DAK.

This station was established April 7, 1905. It is located at Anderson's ranch, about 16 miles northwest of Edgemont, S. Dak., and about 2 miles west of the Argentine water tank on the Chicago, Burlington and Quincy Railroad, just below the mouth of Pass Creek, in the S. ½ sec. 16, T. 7 S., R. 1 E. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 145.

Discharge measurements of Beaver Creek near Edgemont, S. Dak., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 7	H. D. Comstock	38	24	1.21	20
May 17	do	22	7.8	.85	4.6
June 14	do	28	14	1.24	23
June 17	do	24	9.6	.98	9.4
August 4	do	80	99	2.90	312
August 8	do	52	41	1.80	93
September 7	Stevens and Comstock	25	10.7	1.00	11.4
1906.					
May 6	J. E. Stewart	34	26.5	1.57	62.5
May 31	do	33.4	71.0	1.98	110
September 5	do	20	8.9	.88	6.4

Daily gage height, in feet, of Beaver Creek near Edgemont, S. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		2.1	1.2	2.6	1.1	0.55	0.9	1.	1.2
2		2.2	1.3	1.7	1.1	.55	.9	1.1	1.2
3		2.1	2.3	1.7	1.0	.5	.9	1.1	1.2
4		2.1	2.4	1.6	1.0	.5	.9	1.1	1.2
5		2.0	2.2	1.5	1.0	.5	.9	1.1	1.2
6		1.9	1.1	2.7	1.0	.5	.9	1.1	1.2
7		1.8	1.6	1.8	1.0	.5	.85	1.1	1.2
8		1.8	1.4	4.4	1.0	.6	.85	1.1	1.2
9		1.7	1.3	2.95	.9	.55	.8	1.1	1.2
10		1.6	1.2	3.1	.9	.5	.9	1.1	1.2
11		1.6	1.1	3.0	1.95	.5	.9	1.1	1.2
12		1.5	1.1	5.4	1.8	.45	1.0	1.1	1.2
13		1.5	1.1	2.8	1.2	.4	1.0	1.1	1.2
14		1.4	1.1	1.7	1.1	.6	1.0	1.1	1.2
15		1.3	1.05	1.5	1.0	.6	1.0	1.1	1.2
16		1.3	1.0	1.4	.9	.6	1.9	1.1	1.2
17		1.2	1.0	1.3	.85	.6	1.7	1.1	1.3
18		1.2	1.0	1.3	.8	.6	1.5	1.1	1.3
19		1.2	1.0	1.2	.8	.6	1.3	1.1	1.2
20		1.2	1.0	1.2	.8	1.5	1.2	1.1	1.2
21		1.2	1.2	1.2	.8	1.0	1.2	1.1	1.2
22		1.2	1.1	1.2	.75	1.0	1.2	1.1	1.2
23		1.2	2.65	1.15	.7	.9	1.2	1.1	1.2
24		1.2	1.6	1.5	.7	.9	1.1	1.1	1.1
25		1.2	3.3	1.2	.7	.9	1.1	1.1	1.1
26	10.1	1.2	3.75	1.1	.7	.9	1.1	1.1	1.1
27	6.6	1.1	4.0	1.2	.7	.9	1.1	1.1	1.1
28	5.6	1.0	2.8	2.0	.7	.8	1.1	1.1	1.2
29	3.8	1.0	4.1	1.2	.7	.8	1.1	1.1	1.2
30	3.4	1.1	2.4	1.2	.6	.8	1.1	1.2	1.2
31	3.0	....	2.0	....	.55	.9	....	1.2	....

Rating table for Beaver Creek near Edgemont, S. Dak., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.50	1	1.70	73	2.90	313	4.20	675
.60	2	1.80	88	3.00	338	4.40	745
.70	3	1.90	106	3.10	363	4.60	815
.80	5	2.00	125	3.20	389	4.80	890
.90	7	2.10	144	3.30	415	5.00	970
1.00	10	2.20	163	3.40	442	6.00	1,370
1.10	15	2.30	183	3.50	470	7.00	1,820
1.20	22	2.40	203	3.60	498	8.00	2,320
1.30	30	2.50	223	3.70	527	9.00	2,870
1.40	39	2.60	244	3.80	556	10.00	3,470
1.50	48	2.70	266	3.90	585		
1.60	59	2.80	289	4.00	615		

NOTE.—The above table is applicable only for open-channel conditions. It is based on ten discharge measurements made during 1905–6 and is well defined between gage heights 0.8 foot and 3 feet.

Monthly discharge of Beaver Creek near Edgemont, S. Dak., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
April (7–30)	30	12	19.7	938
May	85	5	22.2	1,360
June	428	7	66.4	3,950
July	2,650	15	553	34,000
August	1,780	10	196	12,100
September	22	10	10.6	631
October	223	10	25.3	1,560
November	22	10	14.1	839
The period				55,400
1906.				
March (26–31)	3,530	338	1,290	15,400
April	163	10	55.3	3,290
May	645	10	131	8,060
June	1,130	15	155	9,220
July	116	1	13.4	824
August	48	0	4.9	301
September	106	5	18.8	1,120
October	22	15	15.5	953
November	30	15	21.6	1,290
The period				40,500

NOTE.—Values are rated as follows: April to June, August, October, 1905, April to June, September and November, 1906, excellent; July, 1905, March and August, 1906, fair; September and November, 1905, and July and October, 1906, good.

HAT CREEK NEAR EDGEMONT, S. DAK.

The gaging station was established April 8, 1905, 1 mile above the mouth. May 3, 1906, the station was moved to a point 2 miles above the mouth of the creek and 15 miles southeast of Edgemont, S. Dak., in the S. E. ¼ sec. 25, T. 9 S., R. 4 E.

The channel is straight for 200 feet above and 150 feet below the station. The right bank is high and clean and does not overflow; the left bank is medium high, sparsely wooded, and overflows at very high stages. The bed of the stream is composed of gravel, shale, and mud, and is fairly permanent. There is but one channel at all stages and the current is swift. The stream is frozen from about December 1 to March 10, and observations are discontinued during that period. Gage heights range from 1.5 to 11 feet.

Discharge measurements are made by wading 3 or 4 feet above the gage. The gage, which was read once each day by J. P. Kanten, consists of a 6-inch inclined pine pole spiked to posts driven firmly into the bank. The bench mark is a spike in a cottonwood tree opposite the gage and 25 feet from the water's edge; elevation, 11.16 feet above the zero of the gage.

Discharge measurements of Hat Creek near Edgemont, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 3	J. E. Stewart	45	8.8	2.76	158
May 30	do		281	4.87	120
June 1	do	30	35	2.61	11[illegible]
September 4	do	17	10.8	2.07	13.[illegible]
September 4	do	14.8	6.3	2.07	12.4

NOTE.—These measurements were made at different sections.

Daily gage height, in feet, of Hat Creek near Edgemont, S. Dak., for 1906.

Day.	May.	June.	July.	Day.	May.	June.	July.
1	2.8	2.6	2.3	17	1.8	2.1	.....
2	2.3	2.4	2.3	18	1.8	2.1	.....
3	2.8	2.3	2.1	19	1.8	2.1	.....
4	2.3	2.3	2.1	20	1.8	2.0	.....
5	2.2	2.2	2.1	21	1.7	2.0	.....
6	2.2	2.2	2.3	22	2.8	2.0	.....
7	2.4	2.2	2.0	23	2.1	2.0	.....
8	2.1	2.3	.....	24	2.0	2.5	.....
9	2.0	2.2	.....	25	3.1	3.9	.....
10	1.9	2.1	.....	26	3.5	3.9	.....
11	1.9	2.1	.....	27	3.2	2.4	.....
12	1.8	2.1	.....	28	2.8	5.1	.....
13	1.9	2.1	.....	29	4.7	2.5	.....
14	1.9	2.0	.....	30	4.9	2.8	.....
15	1.9	2.0	.....	31	3.0	.....	.....
16	1.9	2.0	.....				

Rating table for Hat Creek near Edgemont, S. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet	*Sec.-ft.*	*Feet*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet*	*Sec.-ft*
1.70	1	2.60	113	3.50	400	4.40	830
1.80	2	2.70	138	3.60	440	4.50	885
1.90	4	2.80	164	3.70	482	4.60	945
2.00	7	2.90	191	3.80	526	4.70	1,005
2.10	16	3.00	221	3.90	572	4.80	1,065
2.20	30	3.10	253	4.00	620	4.90	1,130
2.30	47	3.20	287	4.10	670	5.00	1,200
2.40	68	3.30	323	4.20	720	5.10	1,270
2.50	90	3.40	361	4.30	775		

NOTE.—The above table is applicable only for open-channel conditions. It is based on five discharge measurements made during 1906, and is well defined between gage heights 2.1 feet and 5.0 feet.

Monthly discharge of Hat Creek near Edgemont, S. Dak., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May	1,130	1	137	8,420
June	1,270	7	114	6,780
July (1–7)	47	7	28.0	38
The period				15,000

NOTE.—Values are rated as follows: May and June, excellent; July, good.

RAPID CREEK AT RAPID, S. DAK.

The gaging station was established June 10, 1903. It is located at a highway bridge one-half mile downstream from the Rapid River Milling Company's mill, and one-fourth mile north of the Chicago and Northwestern Railway in the SE. ¼ sec. 36, T. 2 N., R. 7 E. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 151, where are given also references to publications that contain data for previous years. The data collected at the station are valuable for water-power purposes.

Discharge measurements of Rapid Creek at Rapid, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 31	Comstock and Stewart	36	101	1.69	109
April 6	do	35	91	1.50	76
May 8	J. E. Stewart	33	88	1.60	88
May 26	do	37	116	2.26	241
September 1	do	33	91	1.39	66

Daily gage height, in feet, of Rapid Creek at Rapid, S. Dak., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.60	1.50	2.15	1.55	1.50	1.55	1.55	1.45
2	1.58	1.62	2.12	1.55	2.50	1.58	1.58	1.55
3	1.58	1.70	2.20	1.55	2.80	1.58	1.55	1.45
4	1.50	1.62	2.15	1.30	2.80	1.60	1.55	1.45
5	1.50	1.65	2.10	1.35	2.80	1.60	1.55	1.45
6	1.50	1.60	2.10	1.30	2.65	1.60	1.55	1.45
7	1.50	1.60	2.10	1.30	2.60	1.60	1.50	1.45
8	1.35	1.62	2.00	1.22	2.28	1.60	1.50	1.45
9	1.38	1.65	2.00	1.20	2.28	1.60	1.55	1.55
10	1.45	1.65	1.90	1.50	1.95	1.60	1.55	1.55
11	1.40	1.55	1.90	1.65	1.85	1.55	1.55	1.45
12	1.32	1.58	1.90	1.65	1.80	1.60	1.55	1.45
13	1.45	1.65	1.90	1.60	1.70	1.60	1.55	1.45
14	1.45	1.65	1.90	1.60	1.60	1.60	1.55	1.45
15	1.40	1.60	1.80	1.55	1.55	1.60	1.55	1.45
16	1.35	1.55	1.80	1.60	1.45	1.60	1.55	1.45
17	1.42	1.60	1.80	1.50	1.45	1.55	1.55	1.45
18	1.45	1.55	1.80	1.45	1.45	1.55	1.55	.....
19	1.50	1.48	1.75	1.50	1.45	1.55	1.60	.....
20	1.55	1.40	1.75	1.50	1.50	1.55	1.65	.....
21	1.45	1.52	1.75	1.55	1.60	1.55	1.60	.....
22	1.18	1.48	1.75	1.42	1.60	1.55	1.55	.....
23	1.28	1.38	1.80	1.50	1.60	1.55	1.55	.....
24	1.50	1.62	1.92	1.50	1.52	1.55	1.55	.....
25	1.22	2.45	1.80	1.40	1.55	1.55	1.45	.....
26	1.35	2.28	1.80	1.40	1.60	1.55	1.45	.....
27	1.28	2.30	1.80	1.50	1.55	1.55	1.45	1.40
28	1.30	2.25	1.80	1.55	1.55	1.55	1.45	1.35
29	1.32	2.25	1.80	1.40	1.52	1.55	1.45	1.38
30	1.38	2.25	1.60	1.45	1.55	1.55	1.45	1.45
31	.....	2.25	.....	1.45	1.58	.....	1.45	.....

NOTE.—Ice conditions November 18–26.

Rating table for Rapid Creek at Rapid, S. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	45	1.70	107	2.20	223	2.70	430
1.30	54	1.80	125	2.30	256	2.80	480
1.40	65	1.90	145	2.40	292		
1.50	77	2.00	167	2.50	332		
1.60	91	2.10	193	2.60	380		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904-1906 and is well defined between gage heights 1.3 feet and 2.5 feet.

Monthly discharge of Rapid Creek at Rapid, S. Dak., for 1906.

[Drainage area, 410 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	91	43	67.7	4,030	0.165	0.18
May	312	63	126	7,750	.307	.35
June	223	91	148	8,810	.361	.40
July	99	45	74.3	4,570	.181	.21
August	480	71	166	10,200	.405	.47
September	91	84	87.1	5,180	.212	.24
October	99	71	81.7	5,020	.199	.23
November	84	60	70.5	4,200	.172	.19
The period				49,800		

NOTE.—Discharge estimated November 18-26. Values for April to June are probably excellent. The remainder of the year is somewhat doubtful on account of apparent errors in the gage heights.

CORBIN-MORSE DITCH AT RAPID, S. DAK.

This gaging station was established May 8, 1906. It is located at a highway bridge 300 feet north of the Rapid Creek gaging station and 100 yards below the headworks of the ditch.

Discharge measurements are made from the downstream side of the highway bridge or by wading near the gage.

The gage, which was read once each day by John Merritt, is a post set vertically at the edge of the ditch. The bench mark is the same as that on Rapid Creek.

The following discharge measurements were made in 1906 by J. E. Stewart:

May 8: Width, 5 feet; gage height, 4.31 feet; discharge, 0.65 second-feet.
September 4: Gage height, 438 feet; discharge, 1.0 second-feet.

Daily gage height, in feet, of Corbin-Morse ditch at Rapid, S. Dak., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		5.4	5.15	4.4	4.4	4.4	4.4
2		5.4	5.15	5.4	4.4	4.4	4.4
3		5.4	5.15	5.4	4.4	4.4	4.4
4		5.4	5.15	5.4	4.4	4.4	4.4
5		5.4	5.3	4.4	4.4	4.4	4.4
6		5.4	5.3	4.4	4.4	4.4	4.4
7		5.4	5.15	4.4	4.4	4.4	4.4
8	4.3	4.4	5.3	4.4	4.4	4.4	4.4
9	4.3	4.4	5.3	4.4	4.4	4.4	4.4
10	4.4	4.4	4.4	4.4	4.4	4.4	4.4

Daily gage height, in feet, of Corbin-Morse ditch at Rapid, S. Dak., for 1906—Continued.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
11	4.4	4.4	4.4	4.4	4.4	4.4	4.4
12	4.4	5.5	4.4	4.4	4.4	4.4	.....
13	4.4	5.5	4.55	4.4	4.4	4.4	.....
14	4.4	5.7	4.55	4.4	4.4	4.4	.....
15	4.4	5.7	4.55	4.4	4.4	4.4	.....
16	4.4	5.6	4.55	4.4	4.4	4.4	.....
17	4.4	5.7	4.4	4.4	4.4	4.4	.....
18	4.4	5.7	4.4	4.4	4.4	4.4	.....
19	4.4	5.7	4.4	4.4	4.4	4.4	.....
20	4.4	5.15	4.4	4.4	4.4	4.4	.....
21	4.4	5.15	4.4	4.4	4.4	4.4	.....
22	4.4	5.15	4.4	4.4	4.4	4.4	.....
23	4.4	5.15	4.4	4.4	4.4	4.4	.....
24	4.4	5.15	4.4	4.4	4.4	4.4	.....
25	4.4	5.3	4.4	4.4	4.4	4.4	.....
26	4.4	5.3	4.4	4.4	4.4	4.4	.....
27	4.4	5.3	4.4	4.4	4.4	4.4	.....
28	4.9	5.3	4.4	4.4	4.4	4.4	.....
29	5.4	5.3	4.4	4.4	4.4	4.4	.....
30	5.4	5.3	4.4	4.4	4.4	4.4	.....
31	5.4	.....	4.4	4.4	4.4	4.4	.....

BELLE FOURCHE RIVER AT BELLE FOURCHE, S. DAK.

This station was established May 26, 1903, and was discontinued June 23, 1906. It was located at the county highway bridge on the western outskirts of Belle Fourche, S. Dak., in the NW. ¼, sec. 10, T. 8 N., R. 2 E. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 156, where are given also references to publications that contain data for previous years.

Discharge measurements of Belle Fourche River at Belle Fourche, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 11	Comstock and Stewart	121	179	3.10	493
April 26	J. E. Stewart	75	77	2.10	236

Daily gage height, in feet, of Belle Fourche River at Belle Fourche, S. Dak., for 1906.

Day.	Apr.	May.	June.	Day.	Apr.	May.	June.
1	4.72	4.05	3.90	17	2.65	2.20	6.85
2	4.18	3.48	3.82	18	2.52	2.20	3.20
3	3.62	3.28	3.05	19	2.55	2.10	3.02
4	3.48	3.25	2.80	20	2.55	2.10	2.80
5	3.38	3.20	2.62	21	2.55	2.10	2.50
6	3.22	3.12	2.40	22	2.55	2.10	2.20
7	3.15	2.92	2.80	23	2.55	2.10	2.10
8	2.98	2.75	2.60	24	2.52	3.25	.....
9	2.92	2.55	5.62	25	2.55	4.32	.....
10	2.90	2.40	3.28	26	2.55	5.12	.....
11	2.90	2.40	3.08	27	2.22	4.80	.....
12	2.85	2.40	3.00	28	2.15	4.10	.....
13	2.82	3.00	2.80	29	2.12	4.45	.....
14	2.70	2.70	2.60	30	2.08	3.80	.....
15	2.75	2.30	2.45	31	.....	3.20	.....
16	2.75	2.20	2.42				

Rating table for Belle Fourche River at Belle Fourche, S. Dak., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	150	3.00	530	4.00	1,130	5.00	1,855
2.10	175	3.10	550	4.10	1,200	5.20	2,005
2.20	200	3.20	610	4.20	1,270	5.40	2,155
2.30	230	3.30	670	4.30	1,340	5.60	2,305
2.40	260	3.40	730	4.40	1,410	5.80	2,455
2.50	290	3.50	790	4.50	1,480	6.00	2,610
2.60	330	3.60	850	4.60	1,555	6.20	2,770
2.70	370	3.70	920	4.70	1,630	6.40	2,930
2.80	410	3.80	990	4.80	1,705	6.60	3,090
2.90	450	3.90	1,060	4.90	1,780	6.80	3,250

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906 and is not well defined for 1906.

Monthly discharge of Belle Fourche River at Belle Fourche, S. Dak., for 1906.

[Drainage area, 3,250 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	1,640	170	473	28,100	0.146	0.16
May	1,940	175	606	37,300	.186	.21
June (1–23)	3,290	175	594	27,100	.183	.16
The period				92,500		

NOTE.—Values are rated as follows: April fair, on account of approximate gage heights; May and June, good.

BELLE FOURCHE RIVER NEAR BELLE FOURCHE, S. DAK.

This station was established May 10, 1906. It is located 250 feet below the diversion dam at the headworks of the Belle Fourche irrigation project and 1½ miles from Belle Fourche.

The channel is straight for 250 feet above and 300 feet below the station. The right bank is medium in height, sparsely wooded and subject to overflow at flood stages; the left bank is high and clean and does not overflow. The bed of the stream is shale, sand, and gravel, and is fairly permanent. There is one channel at all stages, and the current is swift.

Discharge measurements are made by means of a cable and car. The initial point for sounding is the inside edge of the frame that supports the cable on the north side of the river.

The gage, which was read twice each day by H. D. Comstock, is an inclined timber spiked to posts driven firmly into the north bank of the stream. The bench mark is a spike driven in a cottonwood tree on the left bank of the river, 150 feet below the gage; the elevation, 10.47 feet above the zero of the gage.

Discharge measurements of Belle Fourche River near Belle Fourche, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq.-ft.*	*Feet.*	*Sec.-ft.*
May 19	J. E. Stewart	117	207	2.08	398
May 24	H. D. Comstock	117	370	3.51	1,060
May 25	Comstock and Green	120	503	4.62	1,870
May 26	Comstock and Magruder	135	870	7.42	4,360
May 26	do	135	826	7.05	4,230
May 26	do	132	728	6.35	3,300
May 26	do	128	638	5.65	2,780
June 11	J. E. Stewart	119	326	3.01	886
June 12	do	118	292	2.72	734
June 27	do	117	169	1.80	314
July 24[a]	H. D. Comstock	[a] 61	[a] 57	1.13	117
September 13	J. E. Stewart	.....	.....	.40	[b] 0
September 27	H. D. Comstock	95	137	1.52	242

[a] Wading section. [b] Water shut off by diversion dam for several hours.

Daily gage height, in feet, of Belle Fourche River near Belle Fourche, S. Dak., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.90	1.58	0.98	1.50	1.50	1.55
2	.....	3.20	1.50	.95	1.45	1.45	1.55
3	.....	2.95	1.48	.98	1.40	1.45	1.55
4	.....	2.70	1.42	1.10	1.38	1.45	1.55
5	.....	2.52	1.38	1.10	1.32	1.45	1.55
6	.....	3.15	1.40	1.25	1.30	1.45	1.60
7	.....	2.82	1.35	2.80	1.20	1.40	1.60
8	.....	2.68	1.35	2.70	1.20	1.40	1.60
9	.....	3.75	1.30	2.00	1.20	1.40	1.55
10	2.50	3.30	1.28	2.18	1.20	1.45	1.55
11	2.38	2.95	1.25	1.88	1.20	1.45	1.55
12	2.28	2.68	1.30	1.68	1.28	1.45	1.55
13	2.25	2.45	1.28	1.55	1.40	1.45	1.60
14	3.02	2.30	1.32	1.48	2.03	1.40	1.65
15	2.35	2.25	1.38	1.38	1.68	1.40	1.65
16	2.20	2.18	1.38	1.30	1.70	1.45	1.60
17	3.05	5.00	1.35	1.20	1.65	1.45	1.50
18	2.25	3.00	1.30	1.12	1.60	1.50	1.50
19	2.10	2.60	1.30	1.10	1.60	1.50	1.45
20	2.05	2.58	1.30	1.20	1.70	1.60	.....
21	2.10	2.25	1.30	1.48	1.70	1.60	.....
22	2.05	2.10	1.15	1.85	1.65	1.60	.....
23	2.08	1.98	1.15	1.62	1.60	1.60	.....
24	3.00	1.92	1.15	1.65	1.58	1.60	.....
25	5.30	1.92	1.10	2.15	1.55	1.60	.....
26	6.50	1.90	1.08	2.00	1.50	1.60	.....
27	4.55	1.80	1.02	1.80	1.50	1.60	.....
28	4.25	1.78	1.00	1.68	1.50	1.60	.....
29	4.30	1.68	1.00	1.60	1.50	1.60	.....
30	3.60	1.60	1.00	1.56	1.50	1.55	.....
31	3.20	.....	1.00	1.50	.....	1.55	.....

Rating table for Belle Fourche River near Belle Fourche, S. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	84	2.10	449	3.20	988	4.60	1,930
1.10	108	2.20	492	3.30	1,046	4.80	2,080
1.20	134	2.30	536	3.40	1,107	5.00	2,240
1.30	162	2.40	581	3.50	1,170	5.20	2,400
1.40	192	2.50	628	3.60	1,235	5.40	2,565
1.50	224	2.60	676	3.70	1,300	5.60	2,735
1.60	258	2.70	725	3.80	1,365	5.80	2,910
1.70	294	2.80	775	3.90	1,430	6.00	3,090
1.80	331	2.90	826	4.00	1,495	6.20	3,270
1.90	369	3.00	878	4.20	1,635	6.40	3,455
2.00	408	3.10	932	4.40	1,780		

NOTE.—The above table is applicable only for open-channel conditions. It is based on ten discharge measurements made during 1906 and is well defined between gage heights 1.1 feet and 8 feet. Daily discharge, May 10 to 25, was reduced 40 second-feet.

Monthly discharge of Belle Fourche River near Belle Fourche, S. Dak., for 1906.

[Drainage area, 4,270 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
May (10-31)	3,550	388	980	12,800	0.230	0.19
June	2,240	258	711	12,300	.167	.19
July	251	84	118	9,100	.035	.04
August	775	72	266	16,100	.062	.07
September	420	134	223	13,300	.052	.06
October	258	192	225	13,800	.053	.06
November	276	192	221	13,200	.052	.06
The period				151,000		

NOTE. Values are excellent.

REDWATER RIVER AT BELLE FOURCHE, S. DAK.

The gaging station was established July 20, 1903, and was discontinued June 23, 1906. It is located at the county highway bridge in the eastern limits of Bellefourche, S. Dak., in the NW. ¼, sec. 11, T. 8 N., R. 2 E., 300 feet above the junction with Bellefourche River. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 159, where are given also references to publications that contain data for previous years.

Discharge measurements of Redwater River at Belle Fourche, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 26	Comstock and Stewart	65	391	5.24	1,190
March 26	do	64	368	1.86	1,020
April 11	do	61	211	2.38	231
April 28	J. E. Stewart	64	195	2.30	198

Daily gage height, in feet, of Redwater River at Belle Fourche, S. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	Day.	Mar.	Apr.	May.	June.
1		2.50	3.20	2.95	17		2.45	2.50	2.85
2		2.50	2.88	2.90	18		2.45	2.50	2.65
3		2.45	2.90	2.85	19		2.35	2.60	2.65
4		2.40	2.90	2.85	20		2.35	2.50	2.50
5		2.40	2.90	2.85	21		2.35	2.50	2.50
6		2.40	2.90	2.85	22		2.35	2.50	2.45
7		2.40	2.88	2.92	23		2.35	2.50	2.45
8		2.40	2.85	2.90	24		2.32	3.00	
9		2.40	2.78	2.98	25		2.35	3.85	
10		2.40	2.68	2.88	26	5.05	2.35	4.15	
11		2.40	2.60	2.80	27	4.30	2.35	3.65	
12		2.40	2.55	2.75	28	3.90	2.35	3.25	
13		2.40	2.50	2.60	29	3.50	2.35	3.15	
14		2.40	2.45	2.50	30	3.10	2.35	3.12	
15		2.40	2.45	2.50	31	2.70		3.00	
16		2.40	2.85	2.50					

Rating table for Redwater River at Belle Fourche, S. Dak., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.30	202	3.10	388	3.80	601	4.50	860
2.40	220	3.20	417	3.90	635	4.60	898
2.50	240	3.30	446	4.00	670	4.70	936
2.60	261	3.40	475	4.10	708	4.80	974
2.70	283	3.50	505	4.20	746	4.90	1,012
2.80	307	3.60	536	4.30	784	5.00	1,050
2.90	333	3.70	568	4.40	822	5.10	1,090
3.00	360						

NOTE.—The above table is applicable only for open-channel conditions. It is based on four discharge measurements made during 1906 and is not well defined.

Monthly discharge of Redwater River at Belle Fourche, S. Dak., for 1906.

[Drainage area, 1,020 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March (26-31)	1,070	283	611	7,270	0.599	0.13
April	240	206	219	13,000	.215	.24
May	727	216	333	20,500	.326	.38
June (1-23)	355	230	281	12,800	.275	.24
The period				53,600		

NOTE.—Values are good.

REDWATER CANAL AT MINNESELA, S. DAK.

This station was established May 7, 1904. It is located on the bridge across the canal in the town of Minnesela, 4 miles from Belle-fourche, S. Dak., in sec. 24, T. 8 N., R. 2 E. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 163, where are given also references to publications that contain data for previous years.

Discharge measurements of Redwater canal at Minnesela, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 13	J. E. Stewart	16	16	2.20	19.3
August 27	do	17	23	2.55	20.6

Daily gage height, in feet, of Redwater canal at Minnesela, S. Dak., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	1.55	3.0	3.7	3.1	2.45	17	.....	2.1	3.2	3.55	2.1	2.1
2	.....	1.62	3.0	3.7	3.1	2.5	18	.....	1.5	3.2	3.4	2.1	2.1
3	.....	1.5	3.0	3.4	3.1	2.5	19	.....	1.5	3.1	3.05	2.1	2.1
4	.....	1.52	3.0	3.1	3.05	2.4	20	.....	2.25	2.5	3.0	2.1	2.1
5	.....	1.5	3.0	3.1	3.0	2.35	21	.....	2.05	1.9	3.0	2.1	2.1
6	.....	1.5	3.0	2.9	3.0	2.3	22	.....	1.6	2.6	3.0	2.1	1.8
7	.....	1.5	3.0	2.6	3.0	2.3	23	.....	1.85	2.6	2.55	2.1	1.8
8	.....	1.5	3.0	2.4	2.85	2.5	24	.....	2.05	3.15	2.1	2.1	1.7
9	.....	1.5	3.3	2.5	2.7	2.5	25	.....	2.3	3.4	2.1	2.1	1.7
10	.....	1.5	3.3	2.5	2.7	2.5	26	.....	2.3	3.55	2.1	2.05	1.65
11	.....	1.8	3.25	2.7	2.7	2.5	27	2.7	2.3	3.35	2.4	2.0	1.6
12	.....	2.0	3.45	2.9	2.7	2.6	28	2.58	2.45	3.5	2.75	2.35	.....
13	.....	2.15	3.25	3.6	2.7	2.7	29	2.05	2.6	3.4	2.7	2.4	.....
14	.....	2.2	3.2	3.6	2.4	2.4	30	2.15	2.6	3.55	3.05	2.4	.....
15	.....	2.2	3.2	3.35	2.1	2.1	31	2.05	.....	3.8	3.1	.....	.....
16	.....	2.1	3.15	3.2	2.1	2.1							

NOTE.—Water turned into canal May 27 and finally turned off October 27.

Daily discharge, in second-feet, of Redwater canal at Minnesela, S. Dak., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1		2	60	113	52	18	17		14	74	92	6	6
2		3	60	113	52	20	18		0	74	82	6	6
3		1	60	89	52	20	19		0	67	56	6	6
4		1	60	67	49	16	20		20	30	54	6	6
5		0	60	67	46	14	21		12	6	54	6	6
6		0	60	53	46	12	22		2	35	54	6	1
7		0	60	35	46	12	23		6	35	28	6	1
8		0	60	25	37	20	24		12	70	10	6	
9		0	81	30	29	20	25		23	89	10	6	
10		0	81	30	29	20	26		20	101	10	5	
11		5	78	41	29	20	27	49	20	85	21	4	
12		11	93	53	29	24	28	42	28	97	39	14	
13		16	78	105	29	29	29	15	35	89	36	16	
14		18	74	105	16	16	30	20	35	101	58	16	
15		18	74	85	6	6	31	15		122	61		
16		14	70	68	6	6							

NOTE.—The daily discharge was obtained from a series of parallel curves, each covering a short period of time.

Monthly discharge of Redwater canal at Minnesela, S. Dak., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May (27-31)	49	15	28.2	280
June	35	0	10.5	625
July	122	6	70.5	4,330
August	113	10	56.3	3,460
September	52	4	22.1	1,320
October (1-23)	29	0	13.2	603
The period				10,600

NOTE.—Values can be probably considered fair.

SPEARFISH CREEK NEAR SPEARFISH, S. DAK.

This station was established March 30, 1904. It is located at the Chicago, Burlington and Quincy Railroad bridge at Bradley's ranch, 1 mile above Spearfish, S. Dak., in the SW. ¼, sec. 14, T. 6 N., R. 2 E. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 161, where are given also references to publications that contain data for previous years. The data collected at this station are valuable for water-power purposes.

Discharge measurements of Spearfish Creek near Spearfish, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 27	H. D. Comstock	27	21	1.02	87
May 2	J. E. Stewart	30	30	1.15	119
June 3	do	26	33	1.27	136
September 7	do	27	24	1.00	65

NOTE.—These measurements were made at different sections.

Daily gage height, in feet, of Spearfish Creek near Spearfish, S. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	1.1	1.15	1.3	1.1	1.0	1.0	1.0	1.0
2	.....	1.1	1.15	1.3	1.1	1.0	1.0	1.0	1.0
3	.....	1.05	1.3	1.25	1.1	1.0	1.0	1.0	1.0
4	.....	1.05	1.5	1.25	1.1	1.0	1.0	1.0	1.0
5	.....	1.0	1.3	1.25	1.1	1.0	1.0	1.0	1.0
6	.....	1.0	1.3	1.2	1.1	1.0	1.0	1.0	1.0
7	.....	1.0	1.3	1.2	1.1	1.35	1.0	1.0	1.0
8	.....	1.0	1.2	1.2	1.1	1.15	1.0	1.0	1.0
9	.....	1.0	1.2	1.2	1.1	1.1	1.0	1.0	1.0
10	.....	1.0	1.2	1.2	1.1	1.05	1.0	1.0	1.0
11	0.95	1.0	1.15	1.2	1.1	1.05	1.15	1.0	1.0
12	.95	1.0	1.15	1.2	1.1	1.05	1.1	1.0	1.0
13	.95	1.0	1.15	1.2	1.1	1.05	1.05	1.0	1.0
14	.95	1.0	1.15	1.2	1.1	1.05	1.05	1.0	1.0
15	1.05	1.0	1.15	1.2	1.1	1.0	1.05	1.0	1.0
16	1.05	1.0	1.15	1.2	1.1	1.0	1.05	1.0	1.0
17	.95	1.0	1.15	1.2	1.05	1.0	1.05	1.0	1.0
18	.95	1.0	1.15	1.2	1.05	1.0	1.05	1.0	1.0
19	.95	1.0	1.15	1.2	1.05	1.0	1.05	1.0	1.0
20	.95	1.0	1.15	1.2	1.05	1.0	1.0	1.2	1.0
21	1.0	1.0	1.15	1.15	1.05	1.0	1.0	1.05	1.0
22	1.0	1.0	1.15	1.15	1.05	1.0	1.0	1.05	1.0
23	1.0	1.0	1.15	1.15	1.0	1.0	1.0	1.05	1.0
24	1.05	1.0	1.3	1.15	1.0	1.0	1.0	1.05	1.0
25	1.05	1.0	1.5	1.15	1.0	1.0	1.0	1.05	1.0
26	1.1	1.0	1.7	1.15	1.0	1.0	1.0	1.05	1.0
27	1.1	1.0	1.6	1.15	1.0	1.0	1.0	1.05	1.0
28	1.1	1.0	1.5	1.1	1.0	1.0	1.0	1.05	1.0
29	1.1	1.05	1.45	1.1	1.0	1.0	1.0	1.05	1.0
30	1.1	1.1	1.4	1.1	1.0	1.0	1.0	1.05	1.0
31	1.1	.....	1.35	.....	1.0	1.0	.....	1.0	.....

NOTE.—Slight ice conditions during March.

Rating table for Spearfish Creek near Spearfish, S. Dak., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	61	1.20	121	1.40	164	1.60	211
1.00	80	1.30	142	1.50	187	1.70	237
1.10	100						

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906, and is not well defined.

Monthly discharge of Spearfish Creek near Spearfish, S. Dak., for 1906.

[Drainage area, 230 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March (11–31)	100	70	81.9	3,410	0.356	0.28
April	100	80	83.0	4,940	.361	.40
May	237	110	136	8,360	.591	.68
June	142	100	119	7,080	.517	.58
July	100	80	92.3	5,680	.401	.46
August	153	80	85.6	5,260	.372	.43
September	110	80	84.0	5,000	.365	.41
October	121	80	84.5	5,200	.367	.42
November	80	80	80.0	4,760	.348	.39
The period	.....	.....	.....	49,700	.....	.....

NOTE.—Values can probably be considered as good.

WHITE RIVER DRAINAGE BASIN.

WHITE RIVER AT INTERIOR, S. DAK.

This station was established June 24, 1904. It is located at the ford, about one-fourth mile northeast of Interior, S. Dak., in T. 3 S., R. 18 E. The gage is in three sections. The upper section is an inclined timber spiked to a stump standing on the left bank and to a post driven in the bank of the stream about 200 feet above the old gage; the middle section is a post driven in the bed of the stream near the upper section; the lower section is a post driven in the middle of the channel about 200 feet from the other two sections.

The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 166, where are given also references to publications that contain data for previous years.

Discharge measurements of White River at Interior, S. Dak., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 4	J. E. Stewart	157	176	2.70	335
May 24	do	112	104	2.58	192
August 30	do	148	224	3.29	483

Daily gage height, in feet, of White River at Interior, S. Dak., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.5	6.05	3.5	2.1	2.8	2.5	2.3	2.5
2	.....	3.5	6.6	3.8	2.1	2.4	2.4	2.2	2.4
3	.....	3.3	5.3	3.0	2.0	2.0	2.4	2.3	2.2
4	.....	2.7	4.2	3.0	2.0	2.3	2.2	2.4	2.0
5	.....	2.6	4.6	2.8	2.0	2.2	2.1	2.4	2.0
6	.....	2.5	3.0	2.8	2.8	2.1	2.0	2.4	2.0
7	.....	2.4	2.6	2.9	2.2	2.1	2.0	2.4	2.0
8	.....	2.3	2.2	3.1	2.1	2.2	2.0	2.3	2.0
9	.....	2.1	2.2	2.8	2.0	2.2	2.2	2.3	2.0
10	.....	2.1	2.0	2.6	2.0	2.2	2.2	2.2	2.0
11	2.5	2.1	1.8	2.4	1.8	2.1	2.1	2.2	2.2
12	2.5	2.9	1.8	2.4	1.7	2.1	2.1	2.2	2.3
13	2.5	2.8	1.8	2.3	1.6	2.0	4.1	2.2	2.1
14	2.5	2.5	4.0	2.3	4.2	2.0	3.2	2.2	2.0
15	2.5	2.4	3.2	2.2	3.6	2.0	3.0	2.2	2.0
16	2.5	2.3	2.2	2.6	2.9	1.8	3.2	2.2	2.0
17	2.5	2.4	2.2	4.0	2.2	1.7	3.0	2.2	2.0
18	2.5	2.5	2.2	3.7	2.2	1.7	3.0	2.2	2.0
19	2.5	2.4	2.2	3.6	2.1	3.0	4.2	5.1	2.0
20	2.5	2.4	2.2	3.3	2.1	7.1	4.8	4.2	2.0
21	2.5	2.4	2.2	3.1	2.0	7.1	4.2	4.0	2.0
22	2.5	2.5	2.3	2.7	2.0	5.5	3.0	3.6	2.0
23	2.5	2.5	3.3	2.5	2.0	4.7	2.8	3.0	2.0
24	5.5	2.8	2.5	2.5	1.8	3.2	2.8	3.0	2.0
25	8.2	3.7	2.8	2.3	1.7	3.0	3.5	2.9	2.0
26	7.0	3.2	3.6	4.1	1.7	4.2	5.2	2.7	2.0
27	6.4	2.5	2.8	3.2	4.8	3.8	4.0	2.6	2.0
28	6.0	2.4	3.2	2.5	3.1	3.8	3.4	2.4	2.0
29	4.3	2.8	5.1	2.3	2.9	3.3	3.2	2.4	2.1
30	4.0	3.9	4.0	2.3	2.7	2.7	2.3	2.3	2.1
31	3.8	.....	3.6	.....	1.9	2.7	...	2.4	...

NOTE.—Ice condition March 15–24.

NIOBRARA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Niobrara River rises in the mountains of eastern Wyoming, flows eastward through the northern portion of Nebraska, and empties into the Missouri in Knox County at the city of Niobrara. Its drainage basin is narrow in the upper portion, but broadens considerably near the mouth; it comprises about 9,012 square miles.

Precipitation within the basin varies from 15 to 18 inches in the upper portion, from 18 to 21 inches in the middle portion, and from 21 to 24 inches in the lower portion. Evaporation is 6, 5, and 4½ feet in the upper, middle, and lower portions, respectively. Sixty-nine per cent of the precipitation falls during April, May, June, July, and August, and about one-half of the remainder is snowfall.

The river is not subject to periodic rises of any extent, owing to the fact that the sand hills which form so large a portion of its drainage area act as storage reservoirs for the rain and snow, which are afterwards fed to the stream in the form of spring water, thus equalizing the flow and making the constancy of the discharge almost phenomenal.

The principal tributaries are Verdigris, Keya Paha, and Snake rivers, and Minnechaduza Creek. The drainage area of the Snake is similar in nearly all respects to that of the western part of the Niobrara.

The water resources of the Niobrara are at present almost wholly undeveloped, irrigation being limited to the low, narrow flood plains in the bottoms of the canyons. On Minnechaduza Creek, at Valentine, an artificial lake has been formed by a dam, and a power plant has been installed for lighting and for furnishing the city with water. On the lower portion of the Niobrara a number of mills are in operation, receiving their power from small tributaries. On Snake River possibilities for power development are phenomenal, but long transmission lines would be required to make it of practical value.

NIOBRARA RIVER NEAR VALENTINE, NEBR.

This station was established July 22, 1897, and was known as the Fort Niobrara station. June 26, 1901, it was moved about 3 miles farther upstream to the Borman Bridge, in sec. 4, T. 34, R. 28, about 3 miles southeast of the town of Valentine. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 168, where are given also references to publications that contain data for previous years. The length of the gage wire is now 11.80 feet.

Discharge measurements of Niobrara River near Valentine, Nebr., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 14 [a]	Geo. W. Bates	110	160	1.55	483
April 18	do	120	228	2.40	1,120
May 1	do	120	207	1.75	998
May 11	do	120	192	1.65	849
June 30	F. S. Dobson	120	167	1.35	627
September 21	Adna Dobson	115	195	1.45	813
December 17	Geo. W. Bates		178	1.70	776

[a] Slush ice running.

Daily gage height, in feet, of Niobrara River near Valentine, Nebr., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.75	1.97	1.90	2.00	1.90	1.45	1.35	1.25	1.35	1.25	1.70
2	1.70	1.92	.....	2.35	2.00	1.50	1.35	1.25	1.30	1.40	1.70
3	1.76	1.95	.....	2.15	1.90	1.50	1.35	1.25	1.30	1.35	1.75
4	1.80	1.90	2.55	2.12	1.90	1.60	1.35	1.60	1.25	1.30	1.75
5	1.82	1.62	2.80	2.07	1.85	1.55	1.40	1.45	1.25	1.30	1.65
6	1.85	1.50	2.55	1.96	1.90	1.55	1.35	1.50	1.25	1.25	1.68
7	1.78	1.75	2.20	1.95	1.75	1.45	1.40	1.60	1.30	1.35	1.60
8	1.55	1.83	2.50	2.10	1.65	1.40	1.30	1.50	1.30	1.35	1.60
9	1.60	1.78	2.25	2.12	1.65	1.30	1.25	1.45	1.30	1.30	1.55
10	1.68	1.85	2.05	2.07	1.60	1.30	1.30	1.55	1.25	1.30	1.55
11	1.63	1.87	1.75	1.98	1.65	1.45	1.55	1.50	1.55	1.25	1.50
12	1.82	1.95	1.32	2.08	1.55	1.40	1.40	1.40	1.35	1.30	1.50
13	1.93	1.75	1.35	2.30	1.60	1.35	1.35	1.45	1.35	1.35	1.55
14	1.85	1.70	1.65	2.32	1.55	1.35	1.40	1.40	1.30	1.35	1.55
15	1.87	1.75	1.60	2.07	1.55	1.40	1.40	1.35	1.40	1.40	1.60
16	1.80	1.95	1.85	2.12	1.50	1.35	1.35	1.30	1.35	1.35	1.60
17	1.85	2.08	1.90	2.05	1.55	1.40	1.35	1.30	1.30	1.45	1.45
18	1.85	2.03	1.95	2.06	1.45	1.35	1.35	1.30	1.30	1.40	1.50
19	1.90	2.15	1.95	2.02	1.40	1.40	1.30	1.25	1.40	1.40	1.40
20	1.85	2.00	1.95	2.05	1.40	1.30	1.30	1.25	1.40	1.70	1.30
21	1.65	1.95	2.12	1.90	1.45	1.30	1.30	1.30	1.45	1.60	1.45
22	1.70	1.90	2.07	1.95	1.45	1.35	1.30	1.30	1.40	1.55	1.50
23	2.45	2.00	2.00	1.95	1.60	1.35	1.30	1.50	1.30	1.50	1.55
24	2.20	1.90	2.10	1.90	1.50	1.40	1.25	1.55	1.30	1.75	1.70
25	2.20	1.85	2.00	1.85	1.55	1.40	1.25	1.50	1.40	1.50	1.65
26	2.15	1.95	2.08	1.85	1.95	1.45	1.25	1.40	1.35	1.65	1.60
27	2.18	1.85	2.15	1.80	1.60	1.45	1.30	1.30	1.30	1.70	1.55
28	2.10	1.92	2.20	1.80	1.50	1.40	1.25	1.35	1.30	1.75	1.60
29	2.10	.....	2.25	1.75	1.60	1.40	1.25	1.30	1.30	1.85	1.70
30	2.05	.....	2.25	1.75	1.55	1.35	1.25	1.30	1.30	1.80	1.65
31	1.95	.....	2.18	.....	1.50	.....	1.25	1.30	.....	1.70	.....

NOTE.—There was considerable slush ice running during January, February, and March. The gage heights for April 25 to 29 were interpolated.

Daily discharge, in second-feet, of Niobrara River near Valentine, Nebr., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	930	1,060	835	1,710	1,180	672	632	595	760	573	985
2	875	1,000	1,080	1,350	1,300	720	632	595	660	685	985
3	940	1,040	1,340	1,120	1,170	720	632	595	660	645	1,040
4	985	985	1,590	1,080	1,100	815	632	907	625	608	1,040
5	997	685	1,950	1,030	1,100	770	675	760	625	608	950
6	1,040	595	1,590	905	1,140	770	635	810	625	573	980
7	950	805	1,120	900	957	682	675	915	665	645	870
8	705	890	1,520	1,070	840	645	600	810	665	645	870
9	750	725	1,180	1,100	835	575	573	760	665	608	820
10	828	890	940	1,050	780	577	607	865	625	608	820
11	778	895	630	945	820	690	820	815	910	573	770
12	970	985	390	1,060	725	648	685	720	710	608	770
13	1,100	770	400	1,350	775	662	645	765	710	645	820
14	1,000	725	562	1,370	730	616	685	725	670	645	820
15	1,030	755	510	1,070	735	655	685	685	760	685	870

Daily discharge, in second-feet, Niobrara River near Valentine, Nebr., for 1906—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
16	930	965	680	1,130	690	620	645	642	715	645	870
17	990	1,120	720	1,060	735	655	652	642	675	730	730
18	990	1,060	790	1,070	655	620	652	647	675	685	770
19	1,050	1,180	790	1,020	620	657	615	610	765	685	685
20	978	995	800	1,060	620	585	615	610	765	985	607
21	768	940	985	925	660	585	620	647	810	870	730
22	815	885	945	1,000	660	620	620	650	685	820	770
23	1,750	970	860	1,020	795	620	620	830	607	770	820
24	1,400	860	995	990	705	662	585	880	607	1,040	985
25	1,400	810	875	950	750	662	590	830	685	770	930
26	1,330	915	990	980	1,200	705	590	740	645	930	870
27	1,370	785	1,060	940	805	705	625	655	607	985	820
28	1,240	855	1,140	960	710	666	590	695	607	1,040	870
29	1,240	.....	1,200	930	810	666	595	655	607	1,160	985
30	1,180	.....	1,220	960	760	630	595	660	607	1,100	930
31	1,060	.....	1,130	.....	715	.....	595	660	.....	985	.....

NOTE.—The daily discharge was obtained by the indirect method for shifting channel conditions.

Monthly discharge of Niobrara River near Valentine, Nebr., for 1906.

[Drainage area, 6,070 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	1,750	705	1,040	64,000	0.171	0.20
February	1,180	595	898	49,900	.148	.15
March	1,950	390	994	61,100	.164	.19
April	1,710	900	1,070	63,700	.176	.20
May	1,300	620	843	51,800	.139	.16
June	815	575	662	39,400	.109	.12
July	820	573	633	38,900	.104	.12
August	915	595	722	44,400	.119	.14
September	910	607	678	40,300	.112	.12
October	1,160	573	760	46,700	.125	.14
November	1,040	607	859	51,100	.142	.16
The period	.....	.....	.....	551,000	.....	.....

NOTE.—Owing to frequent radical changes in the conditions of flow at this station, the above values can not safely be considered as better than approximate. Some of the monthly means may, however, be considerably better and for some months, particularly for January to April, are liable to be worse.

PLATTE RIVER DRAINAGE BASIN.

GENERAL FEATURES.

Considered only with regard to extent of the area drained, the Platte is the most important tributary of the Missouri. It is formed by two forks, North Platte and South Platte, which rise, respectively, in northern and in central Colorado and unite a little southwest of the center of Nebraska. Its entire drainage basin comprises about 90,000 square miles, of which, in round numbers, 36,000 square miles belong to the North Platte and 24,000 to the South Platte. The lower course of the river is fairly well settled, but farther west the population is more scattered.

For convenience the description of the basin is divided, and the North Platte, South Platte, and Platte River proper are considered separately.

NORTH PLATTE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The source of the North Platte is in North Park, Colorado, or rather in the mountains which, rising to elevations from 4,000 to 5,000 feet above its general level, hem it in on all sides. From the steep slopes of these mountains numerous small streams descend, unite below into large creeks, and flow outward to the center of the basin. The two which may be said to form the real head of the North Platte are Grizzly and Little Grizzly creeks, but within the park the river is joined by four large tributaries, Roaring Fork and North Fork from the west and Michigan and Canadian creeks from the east. Leaving the park, the river makes a bold curve northward into Wyoming, but near Caspar, on the north side of the Caspar Range, it turns abruptly to the east and southeast, maintaining the latter course to its point of junction with the South Platte in central Nebraska.

In its northward course through Wyoming the stream receives many tributaries, the Snowy Range on the east contributing its drainage through Douglas, French, and Brush creeks, while the northeast slope of the Sierra Madre is drained by Beaver, Big Cow, and Spring creeks and Grand Encampment River. Medicine Bow and Sweetwater rivers are added to the North Platte between Saratoga and Caspar, beyond which the only important tributary is the Laramie, which enters at old Fort Laramie.

The stream is subject to periodic floods, which reach their maximum at the mouth some time during the latter part of June and are caused by the melting snow on the high ranges in which the headwater streams rise. The river runs lowest in winter, when it freezes thickly. High water prevails from the middle of April to the middle of July, when the river runs bank full.

In the mountain districts the precipitation, which is mostly in the form of snow during the winter and spring months, varies from 7 to 15 inches, the average being about 11 inches. Throughout the lower portion of the basin the precipitation is from 15 to 18 inches and the evaporation from water surface is from 5 to 6 feet.

NORTH PLATTE RIVER AT SARATOGA, WYO.

This station was established June 9, 1903. It is located at a point about 100 yards below the two-span iron-truss bridge which connects East and West Saratoga, in T. 17 N., R. 84 W. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 194, where are given also references to publications that contain data for previous years.

Discharge measurements of North Platte River at Saratoga, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 25	A. J. Parshall	236	868	3.70	3,050
May 11	J. M. Sterrett	235	1,070	4.10	4,290
May 20	do	247	1,210	4.60	5,580
July 26	A. J. Parshall	221	624	2.50	968

Daily gage height, in feet, of North Platte River at Saratoga, Wyo., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1		2.65	3.00	4.52	3.60	2.25	1.88	2.04
2		2.68	2.92	4.38	3.60	2.30	2.00	2.01
3		2.48	2.90	4.32	3.55	2.28	1.96	1.96
4		2.40	3.10	4.35	3.50	2.25	2.03	1.98
5		2.48	3.40	4.68	3.35	2.22	2.00	2.01
6		2.48	3.50	5.22	3.25	2.20	1.91	2.00
7		2.62	3.45	5.00	3.48	2.19	1.88	2.00
8		2.52	3.48	4.65	3.85	2.16	1.84	1.99
9		2.52	3.68	4.40	3.72	2.14	1.79	1.97
10		2.82	3.92	4.42	3.55	2.10	1.74	1.94
11		3.25	4.10	4.72	3.62	2.04	1.75	1.93
12		3.28	4.22	5.02	3.55	1.98	1.74	1.91
13		3.18	4.18	5.38	3.50	1.98	1.72	1.90
14		2.75	4.05	5.60	3.35	2.02	1.72	1.86
15		2.68	3.98	5.55	3.48	2.06	1.88	1.86
16		2.75	4.12	5.50	3.40	2.10	2.08	1.86
17		2.88	4.28	5.50	3.25	2.06	2.13	1.84
18		3.12	4.20	5.10	3.22	2.04	2.28	1.84
19		3.20	4.38	4.82	3.00	2.04	2.30	1.84
20		2.92	4.58	4.52	2.90	2.06	2.30	1.86
21		2.98	4.65	4.35	2.65	2.03	2.28	1.80
22		3.20	4.80	4.32	2.65	2.08	2.22	1.62
23		3.45	4.88	4.20	2.60	2.10	2.13	1.45
24		3.72	4.95	4.18	2.60	2.05	2.09	1.66
25	2.34	3.68	5.25	4.10	2.60	2.02	2.04	1.92
26	2.22	3.40	5.12	3.85	2.58	1.98	2.03	2.08
27	2.15	3.15	5.08	3.75	2.48	1.90	2.04	2.26
28	2.05	3.02	5.12	3.75	2.38	1.86	2.11	2.29
29	2.08	3.05	5.05	3.62	2.32	1.83	2.12	2.26
30	2.22	3.10	5.22	3.60	2.28	1.81	2.06	2.18
31	2.50	.....	4.90	.....	2.25	1.80	.....	2.15

Rating table for North Platte River at Saratoga, Wyo., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	180	2.50	970	3.60	2,905	4.70	5,945
1.50	215	2.60	1,095	3.70	3,145	4.80	6,265
1.60	255	2.70	1,230	3.80	3,390	4.90	6,590
1.70	300	2.80	1,375	3.90	3,645	5.00	6,920
1.80	355	2.90	1,530	4.00	3,905	5.20	7,590
1.90	415	3.00	1,695	4.10	4,175	5.40	8,270
2.00	485	3.10	1,870	4.20	4,455	5.60	8,960
2.10	565	3.20	2,055	4.30	4,740	5.80	9,660
2.20	655	3.30	2,250	4.40	5,030		
2.30	750	3.40	2,455	4.50	5,325		
2.40	855	3.50	2,675	4.60	5,630		

NOTE.—The above table is applicable only for open-channel conditions. It is based on eighteen discharge measurements made during 1905–6 and is well defined.

Monthly discharge of North Platte River at Saratoga, Wyo., for 1906.

Month.	Discharge in second-feet			Total in acre-feet
	Maximum.	Minimum.	Mean.	
March (25-31)	970	525	685	9,510
April	3,190	855	1,670	99,400
May	9,140	1,530	4,740	291,000
June	8,960	2,900	5,670	337,000
July	3,520	702	2,000	123,000
August	750	355	543	33,400
September	750	311	502	29,500
October	740	198	460	28,300
The period				952,000

NOTE.—Values for 1906 are excellent.

NORTH PLATTE RIVER AT PATHFINDER, WYO.

This station was established May 9, 1905. It is located one-half mile south of Pathfinder post-office and 500 feet below the mouth of the canyon. The Pathfinder dam site is one-fourth mile above the station.

The channel is straight for 500 feet above and below the station. The banks are high and will not overflow. The bed is composed of sand and gravel and liable to shift somewhat. The current is sluggish at low stages.

Discharge measurements are made by means of a cable and car. The initial point for soundings is a cross chiseled in the granite ledge to which the north end of the cable is attached.

The gage, which is read daily by employees of the United States Reclamation Service, is a staff fastened to the north bank 50 feet above the cable. The bench mark is a standard United States Geological Survey aluminum tablet cemented in the rock east of the north-cable anchorage; elevation, 25.26 feet above the gage datum and 5,687.4 feet above sea level.

Discharge measurements of North Platte River at Pathfinder, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 8[a]	L. V. Branch	79	381	1.80	199
February 22[a]	do	82	426	1.97	279
April 5	do	199	1,090	4.00	2,180
May 11	do	204	1,410	5.52	4,190
May 22	J. W. Sussex	209	1,840	7.40	8,180
June 22	L. V. Branch	203	1,590	6.47	6,000

[a] Measured under ice.

Daily gage height, in feet, of North Platte River at Pathfinder, Wyo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.70	2.05	4.88	4.45	8.48	4.80	2.38	2.25	2.02	2.50	1.90
2	.....	1.60	2.12	5.08	4.50	7.60	4.78	2.32	2.40	1.98	2.50	2.00
3	.....	1.62	2.08	5.05	4.32	7.00	4.72	2.30	1.75	1.90	2.50	2.00
4	.....	1.68	2.10	4.20	4.15	6.75	4.65	2.35	1.62	1.88	2.55	2.00
5	.....	1.68	2.05	3.92	4.20	6.78	4.52	2.45	1.80	1.82	2.58	2.00
6	.....	1.65	2.05	3.58	4.78	7.10	4.40	2.42	1.78	1.80	2.52	1.88
7	1.40	1.68	2.08	3.95	5.25	7.75	4.22	2.30	1.70	1.80	2.50	1.95
8	1.45	1.75	2.15	3.95	5.20	7.80	4.40	2.20	1.62	1.80	2.48	2.02
9	1.58	1.75	2.15	4.20	5.00	7.42	4.87	2.20	1.58	1.82	2.42	2.10
10	1.60	1.70	2.05	4.38	5.15	6.90	4.90	2.12	1.50	1.80	2.36	2.10
11	1.58	1.72	2.00	4.55	5.55	6.70	4.63	2.05	1.52	1.80	2.28	2.20
12	1.58	1.75	1.88	5.52	6.05	6.95	4.78	2.00	2.08	1.80	2.22	2.18
13	1.55	1.80	1.92	5.52	6.35	7.42	4.85	1.90	1.68	1.75	2.20	2.10
14	1.58	1.82	2.02	5.38	6.48	8.08	4.65	1.95	1.60	1.72	2.18	1.58
15	1.60	1.80	2.10	4.52	6.30	8.55	4.60	1.88	1.98	1.70	2.12	1.50
16	1.60	1.82	2.18	4.02	6.20	8.70	4.60	1.82	1.92	1.68	2.12	1.32
17	1.55	1.85	2.20	3.90	6.32	8.70	4.58	1.82	2.10	1.70	2.05	1.32
18	1.55	1.88	2.20	4.12	6.55	8.55	4.32	1.90	2.40	1.65	1.75	1.45
19	1.52	1.90	2.25	4.58	6.52	8.00	4.02	1.92	2.58	1.65	1.10	1.62
20	1.52	1.90	2.25	4.88	6.60	7.42	3.75	1.92	2.48	1.68	1.38	1.80
21	1.52	1.92	2.28	4.58	6.90	6.82	3.58	2.05	2.40	1.62	1.22	1.95
22	1.55	1.95	2.20	4.33	7.02	6.40	3.40	1.95	2.40	1.58	1.18	2.05
23	1.62	1.95	2.25	4.57	7.35	6.22	3.23	1.92	2.35	1.28	1.10	2.05
24	1.68	1.98	2.32	5.10	7.62	6.22	3.13	1.85	2.28	1.40	0.78	2.05
25	1.68	2.12	3.22	5.53	7.75	6.02	3.03	1.88	2.15	1.85	1.48	2.00
26	1.68	2.10	4.95	5.85	8.32	5.90	2.90	1.82	2.08	1.80	1.85	2.02
27	1.62	2.15	4.80	5.65	8.35	5.67	2.85	1.75	1.98	1.88	1.80	2.05
28	1.62	2.10	4.65	5.23	8.32	5.22	2.78	1.70	1.95	2.28	1.85	2.05
29	1.65	.....	4.50	4.65	8.50	5.02	2.65	1.65	1.98	2.35	1.75	1.88
30	1.65	.....	3.82	4.40	9.18	4.85	2.52	1.58	2.00	2.58	1.78	1.82
31	1.62	.....	3.72	.....	8.85	.....	2.42	1.90	.....	2.62	.....	1.92

NOTE.—Ice 2 feet thick during January and February. Ice commenced to melt in early part of March and river was clear at gaging station March 30. Ice conditions November 18 to December 31.

NORTH PLATTE RIVER AT GUERNSEY, WYO.

This station was established June 14, 1900. It was originally located at the highway bridge about half a mile northwest of Guernsey, Wyo., in sec. 35, T. 27 N., R. 66 W., but at the opening of the season of 1902 the gage rod was removed to the railroad bridge 300 feet above the first location. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 196, where are given also references to publications that contain data for previous years.

Discharge measurements of North Platte River at Guernsey, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 27	A. J. Parshall	329	1,120	3.45	5,340
March 28	do	329	1.000	3.15	4.470
March 29	do	329	1,110	3.45	5,600
April 6	do	326	861	2.80	3,480
April 7	do	319	732	2.55	2,810
April 20	do	327	837	2.80	3,510
May 8	do	329	946	2.95	4,130
May 19	do	329	1,280	3.95	6,380
June 4	do	329	1,660	4.95	9,710
June 17	do	329	1,820	5.70	10,700
June 18	do	329	1,820	5.70	10,600
July 9	do	328	837	2.80	3,340
July 23	do	328	743	2.20	2,570
July 30	do	307	532	1.60	1,560
August 2	do	300	476	1.40	1,330
November 15	R. I. Meeker	235	508	1.50	1,310

Daily gage height, in feet, of North Platte River at Guernsey, Wyo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.80	3.30	5.95	3.45	1.58	0.82	0.90	1.28	1.25
2	2.65	3.25	5.80	3.28	1.48	.80	.90	1.50	1.10
3	2.75	3.15	5.60	3.20	1.38	.78	.88	1.60	1.25
4	2.90	3.15	5.13	3.12	1.32	.72	.85	1.65	1.55
5	3.10	3.15	4.90	3.10	1.30	.70	.80	1.65	1.90
6	2.90	3.07	4.65	3.05	1.40	.78	.80	1.62	2.30
7	2.53	3.05	4.65	3.00	2.05	.80	.80	1.60	1.60
8	2.43	2.95	4.70	2.95	1.70	.80	.80	1.58	1.40
9	2.35	3.20	4.95	2.85	1.45	.80	.80	1.55	1.40
10	2.50	3.45	5.20	2.75	1.32	.80	.80	1.55	1.30
11	2.75	3.53	4.95	2.75	1.22	.80	.85	1.50	1.50
12	3.00	3.53	4.65	3.15	1.10	1.40	.85	1.50	1.75
13	3.20	3.60	5.20	3.00	1.45	1.30	.85	1.50	2.00
14	3.30	3.80	5.35	2.80	1.88	1.15	.82	1.45	1.90
15	3.10	4.00	5.45	3.05	1.82	.95	.80	1.50	1.80
16	3.00	4.15	5.50	3.32	1.80	.85	.80	1.40	1.60
17	3.00	4.05	5.70	3.25	1.75	.90	.80	1.35	1.40
18	2.90	3.95	5.70	2.85	1.70	.90	.80	1.10	1.30
19	2.83	3.95	5.55	2.80	1.70	.98	.80	.95	1.30
20	2.80	4.10	5.35	2.78	1.50	1.00	.80	.80	1.50
21	2.90	4.20	5.30	2.65	1.35	1.05	.88	1.25	1.60
22	3.10	4.25	5.15	2.45	1.75	1.08	.90	1.50	1.70
23	3.30	4.30	4.80	2.15	1.92	1.10	.92	1.65	1.55
24	3.20	4.50	4.60	3.02	1.80	1.00	.98	1.80	1.50
25	3.20	4.65	4.40	2.95	1.40	1.00	1.00	1.50	1.65
26	3.45	4.80	4.25	1.78	1.32	1.00	1.00	1.30	1.55
27	3.70	5.15	4.70	1.70	1.25	1.00	1.02	1.25	1.50
28	3.85	5.70	3.95	1.68	1.18	.95	1.08	1.20	1.50
29	3.70	5.85	3.70	1.65	.95	.92	1.12	1.20	1.50
30	3.40	5.75	3.60	1.60	.90	.90	1.18	1.40	1.45
31	.....	5.75	.....	1.60	.90	.....	1.20	.....	1.35

Rating tables for North Platte River at Guernsey, Wyo.

APRIL 1 TO 30, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.30	2,230	2.80	3,450	3.30	4,950	3.80	6,650
2.40	2,440	2.90	3,730	3.40	5,270	3.90	7,020
2.50	2,670	3.00	4,020	3.50	5,600		
2.60	2,920	3.10	4,320	3.60	5,940		
2.70	3,180	3.20	4,630	3.70	6,290		

MAY 1 TO DECEMBER 31, 1906.[b]

0.70	440	1.80	1,820	2.90	3,850	4.00	6,370
.80	530	1.90	1,980	3.00	4,060	4.20	6,870
.90	630	2.00	2,150	3.10	4,280	4.40	7,390
1.00	730	2.10	2,320	3.20	4,500	4.60	7,920
1.10	840	2.20	2,500	3.30	4,720	4.80	8,460
1.20	960	2.30	2,680	3.40	4,950	5.00	9,000
1.30	1,090	2.40	2,860	3.50	5,180	5.20	9,560
1.40	1,220	2.50	3,050	3.60	5,410	5.40	10,120
1.50	1,360	2.60	3,240	3.70	5,640	5.60	10,690
1.60	1,510	2.70	3,440	3.80	5,880	5.80	11,270
1.70	1,660	2.80	3,640	3.90	6,120	6.00	11,850

[a] This table is applicable only for open-channel conditions. It is based on six discharge measurements made during March and April 1906, and is fairly well defined.

[b] This table is applicable only for open-channel conditions. It is based on ten discharge measurements made during 1906, and is fairly well defined between gage heights 1.4 feet and 6 feet.

Monthly discharge of North Platte River at Guernsey, Wyo., for 1906.

[Drainage area; 16,200 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	6,840	2,340	4,140	246,000	0.256	0.29
May	11,400	3,960	6,580	405,000	.406	.47
June	11,700	5,410	8,990	535,000	.555	.62
July	5,060	1,510	3,510	216,000	.217	.25
August	2,240	630	1,350	83,000	.083	.10
September	1,220	440	672	40,000	.041	.05
October	960	530	629	38,700	.039	.04
November	1,820	530	1,270	75,600	.078	.09
The period				1,640,000		

NOTE.—Values are rated as follows: April to August and November, good; September and October, fair.

NORTH PLATTE RIVER NEAR MITCHELL, NEBR.

This station was established June 3, 1902. It is located at a highway bridge 1 mile south of Mitchell, Nebr., in sec. 27, T. 23 N., R. 56 W., and replaces the station at Gering, Nebr. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 202, where are given also references to publications that contain data for previous years.

Discharge measurements of North Platte River near Mitchell, Nebr., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 12	F. S. Dobson	905	1,330	3.35	3,170
May 8	do		1,500	3.45	3,990
May 8	do	1,020	1,650	3.45	4,260
June 26	Arthur Dobson	1,040	2,140	4.05	6,790
July 24	do	1,570	1,110	3.12	2,630
September 1	do		485	2.45	852
October 16	Arthur Wilson	1,560	364	2.53	643
December 8	A. R. Wilson		862	2.95	2,080

Daily gage height, in feet, of North Platte River near Mitchell, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		3.8	5.1		2.8	2.5	2.5	2.7
2		3.7	5.3	3.7	2.8		2.5	2.7
3		3.6		3.6	2.8	2.4	2.5	2.8
4		3.5	5.0	3.5	2.8	2.4	2.5	
5		3.6	4.8	3.4		2.4	2.5	2.8
6	3.6		4.7	3.4	2.7	2.4	2.5	2.8
7	3.5	3.5	4.6	3.3	2.7	2.4		2.8
8		3.5	4.4		2.7	2.5	2.5	2.8
9	3.4	3.5	4.4	3.2	2.9		2.5	2.7
10	3.3	3.5		3.2	2.8	2.4	2.4	2.7
11	3.3	3.6	4.5	3.2	2.7	2.4	2.4	
12	3.3	3.6	4.4	3.2		2.4	2.4	2.7
13	3.4		4.2	3.3	2.7	2.5	2.4	2.7
14	3.5	3.7	4.0	3.3	2.7	2.6		2.8
15		3.8	3.9		2.6	2.6	2.4	2.9
16	3.8	3.9	4.0	3.3	2.6		2.4	2.8
17	3.8	4.0		3.4	2.5	2.6	2.4	2.8
18	3.7	4.0	4.5	3.5	2.5	2.5	2.4	
19	3.6	3.9	4.5	3.4		2.5	2.5	
20	3.5		4.4	3.3	2.4	2.5	2.5	

Daily gage height, in feet, of North Platte River near Mitchell, Nebr., for 1906.—Concl'd

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
21	3.5	3.9	4.4	3.2	2.4	2.5	.....	.....
22	.....	4.0	4.4	.....	2.5	2.4	2.5	.....
23	3.5	4.1	4.2	3.2	2.7	.....	2.5	.....
24	3.7	4.2	.....	3.1	2.8	2.5	2.6	.....
25	3.6	4.2	4.1	3.1	2.9	2.6	3.0	.....
26	3.6	4.4	4.2	3.0	.....	2.5	2.7	3.0
27	3.6	.....	4.0	3.0	2.9	2.4	2.6	2.6
28	3.8	4.7	4.0	3.0	2.9	2.4	.....	2.5
29	.....	5.2	4.2	.....	2.8	2.4	2.6	2.4
30	3.9	5.3	4.1	2.9	2.7	.....	2.6	2.4
31	.....	5.2	.....	2.8	2.6	.....	2.6	.....

Daily discharge, in second-feet, of North Platte River near Mitchell, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	5,580	14,100	6,110	1,640	940	680	1,400
2	.....	5,070	15,700	5,070	1,640	845	680	1,400
3	.....	4,580	14,500	4,580	1,640	750	680	1,400
4	.....	4,120	13,300	4,120	1,640	680	680	1,400
5	.....	4,580	11,800	3,680	1,510	680	680	1,400
6	4,580	4,350	11,100	3,680	1,380	680	600	1,450
7	4,120	4,120	10,400	3,270	1,380	680	600	1,450
8	3,900	4,120	9,060	3,080	1,380	860	600	1,450
9	3,680	4,120	9,060	2,890	1,920	770	600	1,200
10	3,270	4,120	9,380	2,890	1,640	680	500	1,200
11	3,270	4,580	9,710	2,890	1,380	680	500	1,220
12	3,270	4,580	9,060	2,890	1,380	680	500	1,240
13	3,680	4,820	7,820	3,270	1,380	770	500	1,240
14	4,120	5,070	6,660	3,270	1,380	960	500	1,500
15	4,820	5,580	6,110	3,270	1,150	960	500	1,750
16	5,580	6,110	6,660	3,270	1,150	960	500	1,520
17	5,580	6,660	8,120	3,680	940	960	510	1,520
18	5,070	6,660	9,710	4,120	940	770	510	1,300
19	4,580	6,110	9,710	3,680	845	770	650	1,300
20	4,120	6,110	9,060	3,270	750	770	650	1,300
21	4,120	6,110	9,060	2,890	750	770	675	1,300
22	4,120	6,660	9,060	2,890	940	600	700	1,300
23	4,120	7,230	7,820	2,890	1,380	640	700	1,300
24	5,070	7,820	7,520	2,540	1,640	680	860	1,300
25	4,580	7,820	7,230	2,540	1,920	850	1,820	1,300
26	4,580	9,060	7,820	2,220	1,920	680	1,070	1,080
27	4,580	10,000	6,660	2,220	1,920	530	900	1,080
28	5,580	11,100	6,660	2,220	1,920	530	900	900
29	5,840	14,900	7,820	2,070	1,640	530	900	720
30	6,110	15,700	7,230	1,920	1,380	605	900	720
31	.....	14,900	.....	1,640	1,150	.....	900	.....

NOTE.—A rating table was used April 6 to August 31. After that date the discharge was obtained by the indirect method for shifting channel conditions.

Monthly discharge of North Platte River near Mitchell, Nebr., for 1906.

[Drainage area, 24,400 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Runoff.	
	Maximum.	Minimum.	Mean		Second-feet per square mile.	Depth in inches.
April (25)	6,110	3,270	4,490	223,000	0.184	0.17
May	15,700	4,120	6,850	421,000	.281	.32
June	15,700	6,110	9,260	551,000	.380	.42
July	6,110	1,640	3,190	196,000	.131	.15
August	1,920	750	1,410	86,700	.058	.07
September	960	530	742	44,200	.030	.03
October	1,820	500	708	43,500	.029	.03
November	1,750	720	1,270	75,600	.052	.06
The period	.....	.....	.....	1,640,000	.....	.....

NOTE.—Conditions of flow probably did not vary greatly during 1906, although there have been considerable change since 1905. The above values can not safely be considered as better than fair. Some of the monthly means may, however, be better than fair, while those for September and October are probably only approximate.

NORTH PLATTE RIVER AT BRIDGEPORT, NEBR.

This station was established May 4, 1902. It is located at the highway bridge on the public road about one-half mile north of Bridgeport, Nebr., in sec. 28, T. 20 N., R. 50 W. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 204, where are given also references to publications that contain data for previous years.

Discharge measurements of North Platte River at Bridgeport, Nebr., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 11	F. S. Dobson	2,040	1,600	5.75	3,450
June 27	Arthur Dobson	2,190	2,630	6.05	6,510
July 25	do	2,200	1,180	5.51	2,310
September 2	do	.....	647	4.74	1,140
October 17	A. R. Wilson	2,200	483	4.81	822
December 7	do	2,190	819	5.55	2,190

Daily gage height, in feet, of North Platte River at Bridgeport, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	6.42	7.10	6.20	5.18	4.65	4.76	4.75
2	.....	6.32	7.15	6.10	5.15	4.60	4.76	4.72
3	.....	6.22	7.20	6.00	5.15	4.62	4.72	4.72
4	.....	6.18	7.10	5.90	5.18	4.62	4.72	4.72
5	.....	6.10	7.05	5.80	5.15	4.60	4.70	4.70
6	.....	6.05	7.00	5.75	5.15	4.60	4.74	4.72
7	.....	6.08	6.90	5.70	5.12	4.60	4.73	4.70
8	6.08	6.08	6.85	5.60	5.15	4.62	4.75	4.70
9	5.98	6.00	6.70	5.50	5.16	4.64	4.76	4.70
10	5.88	6.10	6.65	5.90	5.18	4.62	4.75	4.72
11	5.85	6.15	6.65	5.80	5.15	4.62	4.77	.....
12	6.00	6.12	6.60	5.70	5.15	4.60	4.75	.....
13	6.95	6.08	6.60	5.75	5.15	4.60	4.75	.....
14	6.90	6.05	6.50	5.60	5.15	4.62	4.73	.....
15	6.00	6.00	6.40	5.75	5.10	4.64	4.72	.....
16	6.10	6.45	6.40	5.80	5.00	4.60	4.73	.....
17	6.12	6.48	6.45	5.90	4.95	4.62	4.73	.....
18	6.15	6.42	6.50	6.00	4.87	4.64	4.75	.....
19	6.12	6.45	6.55	5.95	4.85	4.68	4.75	.....
20	6.08	6.40	6.60	5.95	4.80	4.70	4.73	.....
21	6.00	6.55	6.75	5.90	4.86	4.70	4.75	.....
22	5.95	6.58	6.70	5.85	4.85	4.70	4.78	.....
23	5.90	6.60	6.60	5.80	4.90	4.68	4.80	.....
24	5.98	6.65	6.50	5.78	4.90	4.65	4.84	.....
25	6.08	6.70	6.40	5.60	4.85	4.65	4.82	.....
26	6.10	6.70	6.30	5.50	4.90	4.65	4.82	.....
27	6.15	6.75	6.28	5.50	4.85	4.68	4.82	.....
28	6.18	6.95	6.25	5.45	4.82	4.70	4.80	.....
29	6.22	7.20	6.20	5.30	4.80	4.70	4.80	.....
30	6.30	7.40	6.15	5.20	4.75	4.70	4.78	.....
31	.....	7.10	.....	5.20	4.70	.....	4.75	.....

Daily discharge, in second-feet, of North Platte River at Bridgeport, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	9,400	16,600	7,800	1,120	800	850	560
2	.....	8,400	17,100	6,900	1,050	760	850	530
3	.....	7,500	17,600	6,000	1,100	800	760	530
4	.....	7,250	16,600	5,200	1,210	800	760	530
5	.....	6,550	16,100	4,400	1,150	750	720	500
6	.....	6,100	15,700	4,000	1,150	750	810	530
7	.....	6,400	14,600	3,650	1,180	750	780	400
8	6,000	6,400	14,200	3,000	1,260	800	830	400
9	5,200	5,700	12,600	2,400	1,400	840	750	300
10	4,400	6,500	12,100	5,200	1,500	800	740	300
11	4,150	7,000	12,100	4,400	1,450	800	790	.....
12	5,450	6,700	11,600	3,650	1,450	660	740	.....
13	14,500	6,400	11,600	4,050	1,500	660	740	.....
14	14,000	6,100	10,600	3,000	1,500	720	690	.....
15	5,450	5,820	9,600	4,050	1,430	760	680	.....
16	6,300	9,900	9,600	4,400	1,070	660	690	.....
17	6,450	10,200	10,200	5,200	1,000	720	690	.....
18	6,750	9,600	10,700	6,000	800	760	640	.....
19	6,450	9,900	11,200	5,600	810	850	640	.....
20	6,100	9,450	11,700	5,600	700	900	600	.....
21	5,450	10,900	13,200	5,200	900	800	640	.....
22	5,050	11,200	12,700	4,800	860	800	700	.....
23	4,750	11,400	11,700	4,400	1,090	740	750	.....
24	5,400	11,900	10,700	4,250	1,090	680	850	.....
25	6,300	12,400	9,800	3,000	1,030	680	780	.....
26	6,440	12,600	8,800	2,300	1,190	680	780	.....
27	6,900	13,000	8,600	2,300	1,120	740	780	.....
28	7,150	15,100	8,250	2,150	1,040	800	660	.....
29	7,500	17,300	7,800	2,450	1,060	800	660	.....
30	8,220	19,700	7,300	1,140	950	730	640	.....
31	.....	16,600	.....	1,140	920	.....	560	.....

NOTE.—The daily discharge was obtained by the indirect method for shifting channel conditions.

Monthly discharge of North Platte River at Bridgeport, Nebr., for 1906.

[Drainage area, 23,200 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April (8-30)	14,500	4,150	6,710	306,000	0.289	0.25
May	19,700	5,700	9,790	602,000	.422	.49
June	17,600	7,300	12,000	714,000	.517	.58
July	7,800	1,140	4,120	253,000	.178	.21
August	1,500	700	1,130	69,500	.049	.06
September	900	660	760	45,200	.033	.04
October	850	560	727	44,700	.031	.04
November (1-10)	560	400	478	9,480	.021	.01
The period	.....	.....	.....	2,050,000	.....	.....

NOTE. Values for April to July can probably be considered as fair; values for August to November can not safely be considered as better than approximate, owing to great changes in the conditions of flow during that period.

NORTH PLATTE RIVER AT NORTH PLATTE, NEBR.

This station was established October 5, 1894. It is located 3½ miles above the junction of North and South Platte rivers, at a highway bridge about one-half mile north of the city of North Platte, in sec. 28, T. 14 N., R. 30 W. It is the lowest station on the river. The conditions at this station are described in Water-Supply Paper No. 172, page 207, where are given also references to publications

that contain data for previous years. The present bench mark is the top of the southwest corner of the east concrete abutment of the new railroad bridge (same location as the old); elevation above gage datum, 8.20 feet.

Discharge measurements of North Platte River at North Platte, Nebr., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 22	F. S. Dobson	.....	3,270	2.65	5,100
April 10	do	1,920	2,320	2.80	5,930
May 9	do	.....	2,370	2.60	5,500
July 2	Arthur Dobson	2,000	2,530	2.85	6,330
August 1	do	1,740	843	2.00	1,530
September 7	do	.....	617	1.75	1,040
November 3	do	.....	1,410	2.52	3,130
November 13	A. R. Wilson	1,720	1.100	2.35	2,570

Daily gage height, in feet, of North Platte River at North Platte, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	2.95	3.70	2.88	2.08	2.05	1.92	2.35
2	.....	2.90	3.75	2.88	2.05	2.05	1.95	2.32
3	.....	2.95	3.78	2.90	1.92	2.02	1.95	2.55
4	.....	2.88	3.78	2.82	1.85	2.00	1.90	2.50
5	.....	2.92	3.98	2.80	1.88	2.00	1.90	2.40
6	.....	2.88	3.85	2.70	2.20	1.88	1.88	2.38
7	.....	2.70	3.80	2.60	2.38	1.78	1.85	2.35
8	.....	2.62	3.35	2.50	2.10	1.72	1.82	2.32
9	.....	2.60	3.20	2.48	1.95	1.70	1.90	2.32
10	2.80	2.60	3.05	2.45	1.85	1.70	1.90	2.38
11	2.78	2.62	3.02	2.45	1.80	1.85	1.90	2.40
12	2.88	2.60	3.10	2.40	1.70	2.08	1.90	2.40
13	3.00	2.65	3.10	2.42	1.62	2.00	1.90	2.30
14	2.80	2.65	3.15	2.50	1.55	2.00	2.00	2.30
15	2.75	2.75	3.10	2.45	1.60	1.88	2.00	2.25
16	2.68	2.85	3.10	2.35	1.60	1.70	1.95	2.28
17	2.70	2.78	2.92	2.22	1.52	1.78	1.98	2.25
18	2.68	2.78	2.80	2.28	1.48	1.85	1.92	2.20
19	2.82	2.92	2.90	2.32	1.42	1.85	1.95	2.20
20	2.88	3.00	2.98	2.38	1.30	2.02	1.98	2.02
21	2.80	3.18	3.12	2.42	1.20	2.02	1.85	1.85
22	2.75	3.05	3.20	2.60	1.08	2.00	2.12	1.85
23	2.70	3.05	3.18	2.52	1.82	2.00	2.45	1.98
24	2.72	3.08	3.25	2.40	2.10	1.98	2.15	2.10
25	2.68	3.32	3.22	2.42	1.88	2.00	2.05	2.28
26	2.55	3.20	3.12	2.40	1.95	1.92	2.18	2.35
27	2.75	3.20	3.15	2.45	1.78	1.90	2.35	2.25
28	2.95	3.20	3.05	2.30	1.68	1.90	2.75	2.20
29	2.82	3.22	2.95	2.20	1.65	1.88	2.85	2.20
30	2.75	3.35	2.90	2.10	1.85	1.90	2.50	2.38
31	.....	3.52	.....	2.10	2.10	.....	2.38	.....

Daily discharge, in second-feet, of North Platte River at North Platte, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	7,490	15,400	6,910	1,900	2,080	1,200	2,400
2	.....	7,070	16,100	6,910	1,750	2,080	1,280	2,200
3	.....	7,490	16,400	7,070	1,320	1,940	1,220	3,340
4	.....	6,910	16,400	6,440	1,170	1,870	1,060	3,080
5	.....	7,240	19,000	6,280	1,230	1,870	1,060	2,570
6	.....	6,910	17,300	5,540	2,400	1,410	1,000	2,500
7	.....	5,540	16,700	4,850	3,320	1,120	920	2,370
8	.....	4,990	11,300	4,200	1,960	900	760	2,300
9	.....	4,850	9,770	4,080	1,380	840	980	2,300
10	6,280	4,850	8,360	3,900	1,060	840	980	2,570

Daily discharge, in second-feet, of North Platte River at North Platte, Nebr., for 1906. Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept	Oct.	Nov
11	6,130	4,990	8,090	3,900	1,000	1,280	980	2,660
12	6,910	4,850	8,810	3,600	750	2,200	980	2,860
13	7,910	5,200	8,810	3,720	570	1,770	950	2,350
14	6,280	5,200	9,290	4,200	445	1,770	1,200	2,320
15	5,910	5,910	8,870	3,900	530	1,340	1,260	2,080
16	5,400	6,680	8,810	3,320	530	780	1,080	2,230
17	5,540	6,130	7,240	2,640	394	1,160	1,200	2,080
18	5,400	6,130	6,280	2,950	330	1,170	940	1,880
19	6,440	7,240	7,070	3,160	260	1,170	1,020	1,880
20	6,910	7,910	7,740	3,490	170	1,750	1,120	1,230
21	6,280	9,580	9,000	3,720	100	1,750	760	750
22	5,910	8,360	9,770	4,850	50	1,670	1,600	750
23	5,540	8,360	9,580	4,330	1,140	1,560	3,000	1,100
24	5,690	8,630	10,300	3,600	2,200	1,480	1,630	1,500
25	5,400	11,000	9,970	3,720	1,340	1,550	1,260	2,230
26	4,520	9,770	9,000	3,600	1,600	1,260	1,760	2,550
27	5,910	9,770	9,290	3,900	1,040	1,200	2,480	2,080
28	7,490	9,770	8,360	3,050	740	1,120	4,600	1,880
29	6,440	9,970	7,490	2,540	740	1,060	5,300	1,880
30	5,910	11,300	7,070	2,080	1,300	1,120	3,130	2,710
31	.....	13,200	.....	2,080	2,300	.....	2,520	.....

NOTE.—The daily discharge was obtained from a rating table April 10 to July 31. After that date the indirect method for shifting channel conditions was used.

Monthly discharge of North Platte River at North Platte, Nebr., for 1906.

[Drainage area, 28,500 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April (10-30)	7,910	4,520	6,100	254,000	0.214	0.17
May	13,200	4,850	7,530	463,000	.264	.30
June	19,000	6,280	10,600	631,000	.372	.42
July	7,070	2,080	4,150	255,000	.146	.17
August	3,320	50	1,130	69,500	.040	.05
September	2,200	780	1,470	87,500	.052	.06
October	5,300	760	1,590	97,800	.056	.06
November	3,340	750	2,150	128,000	.075	.08
The period	.....	.....	.....	1,990,000		

NOTE.—Values are rated as follows: April to July, good; August to November, fair.

MISCELLANEOUS MEASUREMENT.

A discharge measurement of North Platte River at Pinkhampton, Colo., on September 23, 1906, gave the following result:

Width, 68 feet; area of section, 52 square feet; gage height, 3.88 feet; discharge, 38 second-feet.

SOUTH PLATTE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The headwaters of the South Platte have their sources in the mountainous region surrounding the large basin near the center of the State of Colorado known as South Park and in the long eastern slopes of the high mountains forming the Continental Divide. The

general course of the stream is eastward to Lake George, thence through Platte Canyon northward to the junction with Cache la Poudre River near Greeley, and thence eastward until it joins the North Platte at the town of North Platte, Nebr.

Precipitation varies from 25 inches along the Continental Divide, where the greater part of it is snowfall, to 14 to 17 inches among the foothills. Evaporation records are meager.

In the mountainous region the flow of the South Platte and its tributaries is perennial; but in the plains area the volume is greatly diminished, owing to the fact that the normal waters are completely diverted for irrigation, the capacity of the canals far exceeding the discharge of the river. At North Platte, Nebr., just above the mouth of the river, the stream channel is dry for the greater part of the year or consists of several small channels carrying a few second-feet of water.

The tributaries of the South Platte comprise, first, the small streams that rise on the eastern slopes of the Rocky Mountains, and, second, the plains streams. The mountain streams furnish a perennial supply of water, the amount of which, however, varies with the snowfall, being light during the latter part of the summer and in the fall and winter, and large during the spring floods. This water is almost entirely diverted for irrigation and does not reach the South Platte except in times of heavy floods. The principal streams of this class are Bear, Clear, Boulder, and St. Vrain creeks and Big Thompson and Cache la Poudre rivers. The plains streams are all intermittent in their nature and furnish water only during storms or in the season of melting snow. The chief streams of this class are Cherry, Lone Tree, Kiowa, Boxelder, Bijou, Beaver, and Pawnee creeks.

The South Platte is subject to periodic floods, which occur in May and June, the magnitude varying from year to year with seasonal precipitation and temperature. At Julesburg, on the eastern margin of the basin in Colorado, the stream may vary from no flow up to 12,000 second-feet.

SOUTH PLATTE RIVER AT SOUTH PLATTE, COLO.

This station was established March 28, 1902, at the wagon bridge crossing the South Platte about 150 feet below the junction of North and South forks at the town of South Platte, a station on the Colorado and Southern Railway about 9 miles above the mouth of the canyon. May 7, 1905, the old station was abandoned and a new station established at a point 150 feet below the county bridge. The station is very near the Colorado and Southern Railway station and is easily accessible from Denver. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 217, where

are given also references to publications that contain data for previous years.

This station is of special importance, its location being above the diverting gates of all irrigating ditches and also above the intake of the Denver Union Water Company, which derives the greater part of its supply from the South Platte, a few miles below. The location of the Cheesman storage reservoir on the South Fork 20 miles above this station and the contemplated installation of large power plants on the two forks at points above also add to the importance of the station as a base from which to secure data. Bridges across each fork above the main station allow of measurements being made on these streams, thereby checking all gagings on the main stream.

Discharge measurements of South Platte River at South Platte, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 2	M. C. Hinderlider	75	137	2.25	337
May 4	do	77	202	3.10	780
June 1	T. E. Brick	79	225	3.25	804
June 18	do	78	237	3.42	986
June 30	M. C. Hinderlider	75	148	2.40	388
October 3	R. I. Meeker	76	179	3.00	603
October 30	do	75	182	3.00	608

Daily gage height, in feet, of South Platte River at South Platte, Colo., for 1906.

Day.	Jan.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.95	2.15	3.10	3.18	2.40	2.30	2.30	3.12	3.00
2	1.85	2.25	3.10	3.22	2.40	2.32	2.38	3.02	3.05
3	1.35	2.35	3.00	3.10	2.48	2.30	2.75	3.00	2.98
4	1.35	2.22	3.10	3.15	2.40	2.50	2.90	3.00	2.90
5		1.90	3.15	3.22	2.55	2.40	3.20	3.00	2.95
6		2.10	3.05	3.20	2.75	2.35	2.95	3.00	2.80
7		2.45	3.10	3.00	2.80	2.32	2.80	3.00	2.80
8		2.38	3.10	2.85	3.15	2.30	2.52	2.95	2.80
9		2.38	3.12	2.80	3.30	2.20	2.50	2.95	2.60
10		2.50	3.22	2.80	3.45	2.28	2.50	2.90	2.60
11		2.60	3.20	3.00	3.25	2.30	2.50	2.80	2.70
12		2.75	3.20	3.02	3.08	2.18	2.50	2.75	2.70
13		2.62	3.12	3.32	2.90	2.15	2.35	2.75	2.70
14		2.42	3.05	3.25	2.95	2.20	2.30	2.70	2.65
15		2.32	3.10	3.55	3.15	2.20	2.22	2.70	2.60
16		2.35	3.05	3.70	3.20	2.30	2.45	2.70	2.60
17		2.40	3.15	3.50	2.95	2.30	2.50	2.60	2.52
18		2.48	3.22	3.38	2.75	2.20	2.78	2.60	2.50
19		2.60	3.25	3.32	2.70	2.20	2.85	2.60	2.20
20		2.65	3.50	3.15	2.50	2.20	2.75	2.60	2.20
21		2.70	3.62	2.95	2.40	2.30	2.60	2.60	2.10
22		2.70	3.90	2.90	2.40	2.25	2.60	2.60	2.10
23		2.85	3.90	2.85	2.40	2.32	2.50	2.50	2.10
24		2.90	3.85	2.75	2.60	2.65	2.40	2.50	2.10
25		2.75	3.90	2.68	2.70	2.75	2.32	2.50	2.12
26		2.70	3.92	2.70	2.50	2.78	2.50	2.50	2.05
27		2.65	3.65	2.52	2.40	2.50	3.15	2.65	2.02
28		2.60	3.62	2.48	2.42	2.48	3.60	2.72	2.10
29		2.82	3.52	2.40	2.30	2.40	3.58	3.05	2.10
30		3.08	3.15	2.40	2.30	2.35	3.50	3.00	2.12
31			3.10		2.30	2.30		3.00	

Daily discharge, in second-feet, of South Platte River at South Platte, Colo., for 1906.

Day.	Jan.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	224	300	780	770	388	340	320	660	608
2	198	337	780	790	388	350	350	610	630
3	100	375	730	725	420	340	495	603	590
4	100	328	780	765	388	420	565	603	560
5	.....	220	810	800	490	380	710	603	580
6	.....	285	755	790	530	350	590	603	515
7	.....	433	780	690	555	340	520	603	515
8	.....	408	765	630	725	330	410	580	515
9	.....	408	775	610	800	295	400	580	430
10	.....	452	830	610	885	325	400	560	430
11	.....	295	820	705	775	332	400	510	470
12	.....	560	820	720	690	290	400	490	470
13	.....	502	775	905	595	280	340	490	470
14	.....	410	740	865	615	295	320	470	450
15	.....	395	750	1,040	710	295	290	470	430
16	.....	405	730	1,140	740	332	380	470	430
17	.....	425	780	1,030	615	332	400	430	400
18	.....	460	820	960	525	295	510	430	390
19	.....	505	835	920	505	295	540	430	275
20	.....	530	975	830	420	295	510	430	275
21	.....	550	1,050	690	380	332	440	430	245
22	.....	550	1,220	665	380	315	440	430	245
23	.....	640	1,220	640	380	340	385	390	245
24	.....	665	1,185	575	460	470	350	390	245
25	.....	590	1,220	540	505	515	320	390	250
26	.....	570	1,230	550	420	530	385	390	230
27	.....	545	1,060	460	380	410	670	455	223
28	.....	525	1,035	440	390	405	915	480	245
29	.....	620	960	405	340	370	900	625	245
30	.....	755	750	395	340	340	750	608	250
31	.....	.....	725	.....	340	320	.....	608	.....

NOTE.—The daily discharge was obtained by the indirect method for shifting channel conditions.

Monthly discharge of South Platte River at South Platte, Colo., for 1906.

[Drainage area, 2,610 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	755	220	468	27,800	0.179	0.20
May	1,230	725	887	54,500	.340	.39
June	1,140	395	722	43,000	.277	.31
July	885	340	519	31,900	.199	.23
August	530	280	350	21,500	.134	.15
September	915	290	480	28,600	.184	.21
October	660	390	510	31,400	.195	.22
November	630	223	395	23,500	.151	.17
The period	.....	.....	.....	262,000	.....	.....

NOTE.—Values for 1906 are probably good.

SOUTH FORK OF SOUTH PLATTE RIVER AT SOUTH PLATTE, COLO.

This station was established May 8, 1905, for the purpose of collecting data in regard to the run-off of the South Fork drainage basin and also to furnish information concerning power and irrigation possibilities on the stream. It is located about 500 feet above the junction of North and South forks of South Platte River, in T. 7 S., R. 20 W., and about 700 feet above the wagon bridge at which the old station on the South Platte was located. The conditions at this station and the bench marks are described in Water-Supply

Paper No. 172, page 220, where are given also references to publications that contain data for previous years.

Discharge measurements of South Fork of South Platte River at South Platte, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 4	R. I. Meeker	16	15	[a] 2.10	32
April 2	M. C. Hinderlider	58	81	2.30	260
May 4	do	60	117	2.70	412
June 1	T. E. Brick	58	75	2.20	208
June 18	do	58	109	2.80	402
June 30	M. C. Hinderlider	50	35	1.35	79
October 3	R. I. Meeker	59	102	2.60	364
October 30	do	60	117	2.80	446

[a] Ice measurement. Gage height affected by ice.

Daily gage height, in feet, of South Fork of South Platte River at South Platte, Colo., for 1906.

Day.	Jan.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	2.40	2.25	2.30	2.20	1.32	1.80	2.00	2.80	2.80
2	2.60	2.30	2.90	2.20	1.32	1.82	2.08	2.68	2.75
3	2.10	2.45	2.75	2.20	1.40	1.80	2.25	2.62	2.70
4	2.08	2.18	2.70	2.30	1.40	2.02	2.80	2.50	2.70
5		1.70	2.80	2.30	1.90	2.00	3.10	2.50	2.65
6		1.90	2.75	2.22	2.32	1.95	2.75	2.50	2.60
7		2.18	2.70	2.02	2.32	1.95	2.50	2.55	2.60
8		2.30	2.70	1.95	2.65	1.90	2.40	2.45	2.60
9		2.25	2.70	1.90	2.80	1.90	2.30	2.45	2.50
10		2.30	2.70	1.90	3.08	1.88	2.10	2.40	2.50
11		2.40	2.70	1.82	2.85	2.00	2.10	2.40	2.50
12		2.60	2.70	1.82	2.55	1.95	2.10	2.40	2.45
13		2.55	2.68	1.95	2.40	1.80	2.02	2.40	2.45
14		2.35	2.65	1.95	2.32	1.80	1.95	2.40	2.40
15		2.28	2.62	2.60	2.50	1.80	1.82	2.40	2.40
16		2.22	2.65	2.90	2.65	1.95	1.95	2.40	2.40
17		2.20	2.48	2.80	2.40	2.00	2.20	2.30	2.40
18		2.30	2.40	2.82	2.20	2.00	2.48	2.30	2.40
19		2.50	2.40	2.68	2.10	1.95	2.40	2.30	1.90
20		2.55	2.50	2.38	2.00	1.95	2.40	2.30	1.70
21		2.50	2.75	2.05	1.90	2.00	2.30	2.30	1.70
22		2.50	2.90	1.88	1.70	2.00	2.05	2.30	1.60
23		2.60	2.90	1.78	1.90	2.10	2.00	2.28	1.60
24		2.65	3.10	1.80	2.15	2.30	2.00	2.25	1.50
25		2.60	3.35	1.85	2.20	2.65	1.92	2.20	1.50
26		2.50	3.35	1.80	2.00	2.62	2.00	2.30	1.50
27		2.50	2.90	1.75	1.90	2.45	2.80	2.35	1.50
28		2.45	2.80	1.58	1.80	2.25	3.25	2.45	1.65
29		2.62	2.58	1.42	1.80	2.08	3.38	2.60	1.70
30		2.82	2.38	1.38	1.90	2.00	3.02	2.85	1.70
31			2.25		1.80	2.00		2.80	

NOTE.—January gage heights affected by ice condition.

Rating table for South Fork of South Platte River at South Platte, Colo., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	70	1.90	165	2.50	335	3.10	615
1.40	80	2.00	190	2.60	370	3.20	670
1.50	95	2.10	215	2.70	410	3.30	730
1.60	110	2.20	240	2.80	455	3.40	790
1.70	125	2.30	270	2.90	505		
1.80	145	2.40	300	3.00	560		

NOTE.—The above table is applicable only for open-channel conditions. It is based on twenty-three discharge measurements made during 1905–6, and is well defined between gage heights 1.3 feet and 3.5 feet.

Monthly discharge of South Fork of South Platte River at South Platte, Colo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	465	125	301	17,900
May	760	255	435	26,700
June	505	78	224	13,300
July	604	72	240	14,800
August	390	145	199	12,200
September	778	149	310	18,400
October	480	240	319	19,600
November	455	95	258	15,400
The period				133,000

NOTE.—Values are rated as follows: April and July to November, excellent; May and June, good.

SOUTH PLATTE RIVER AT DENVER, COLO.

In the spring of 1895 a river station was established at the Twenty-third Street Viaduct in the city of Denver, but observations were discontinued June 18 of the same year, as the location was found to be unfavorable for accurate measurements and the water had fallen below the gage. In July, 1895, a station was established at the Fifteenth Street Bridge. The present station is located at a point immediately below the mouth of Cherry Creek, which enters between the Fourteenth and Fifteenth street bridges. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 223, where are given also references to publications that contain data for previous years.

Discharge measurements of South Platte River at Denver, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 2	W. A. Lamb	56	41	0.75	63
March 26	do	54	55	1.07	116
April 11	M. C. Hinderlider	133	109	1.38	195
May 1	T. E. Brick	171	290	2.60	834
June 5	do	150	154	1.80	342
June 15	do	131	121	1.62	283
September 29	R. I. Meeker	169	246	2.30	657
October 6	C. L. Chatfield	161	186	1.80	397
October 24	do	170	268	2.30	716
October 29	do	170	287	2.50	881
November 8	do	169	263	2.25	758
November 13	do	162	243	2.15	660

Daily gage height, in feet, of South Platte River at Denver, Colo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	0.70	1.00	0.70	1.08	2.70	1.90	1.48	1.52	1.70	1.92	2.50
2	.70	.90	.68	1.35	2.55	1.85	1.62	1.50	1.72	1.85	2.52
3	.70	.95	.70	1.50	2.60	1.82	1.75	1.42	1.70	1.78	2.50
4	.70	1.00	.70	1.78	2.60	1.80	1.90	1.55	1.70	1.70	2.45
5	.72	.85	1.02	1.40	2.70	1.82	1.82	1.62	1.72	1.72	2.40
6	.70	.65	.95	1.10	2.72	1.82	1.82	1.48	1.60	1.80	2.38
7	.70	.70	1.12	1.10	2.70	1.80	1.92	1.45	1.55	1.82	2.25
8	.70	.72	1.05	1.38	2.75	1.80	2.00	1.42	1.38	1.80	2.20
9	.70	.72	1.02	1.32	2.60	1.72	2.05	1.52	1.22	1.75	2.20
10	.68	.70	1.00	1.42	2.45	1.80	1.92	1.42	1.35	1.65	2.20
11	.75	.70	1.00	1.40	2.38	1.82	1.80	1.45	1.38	1.62	2.15
12	.72	.90	.88	1.40	2.22	1.90	1.65	1.48	1.45	1.70	2.15
13	.75	1.02	.75	1.30	2.10	1.92	1.42	1.62	1.62	1.72	2.15
14	.75	.75	.90	1.30	2.00	1.90	2.08	1.65	1.70	1.75	2.10
15	.78	.80	.80	1.15	2.02	1.92	2.35	1.60	1.65	1.45	2.00
16	.82	.90	.65	.85	1.95	1.85	2.00	1.50	1.60	1.48	1.92
17	.85	.90	.80	.80	1.85	2.00	1.52	1.62	1.55	1.60	1.88
18	.85	.85	.80	.78	1.85	1.95	1.38	1.58	1.88	1.68	1.80
19	.85	.90	.80	.98	1.80	1.65	1.32	1.58	1.95	1.65	1.78
20	.90	.92	.78	1.28	1.85	1.38	1.60	1.55	1.80	1.70	1.70
21	.85	.95	.98	1.35	1.80	1.42	1.62	1.45	1.60	1.75	1.80
22	.85	1.00	1.12	1.30	2.00	1.52	1.60	1.45	1.50	1.90	1.80
23	.85	1.08	1.30	1.40	2.28	2.10	1.60	1.68	1.45	2.00	1.80
24	.88	.98	1.30	1.55	2.15	2.00	1.50	1.82	1.35	2.08	1.78
25	.90	.92	1.45	1.60	2.15	1.90	1.50	1.90	1.15	2.20	1.80
26	.90	1.00	1.30	1.70	2.65	1.65	1.58	2.02	1.35	2.18	1.70
27	1.10	1.00	1.38	1.78	2.80	1.50	1.60	1.90	1.85	2.28	1.62
28	1.00	.70	1.10	1.90	2.55	1.40	1.60	1.92	2.02	2.35	1.60
29	1.00	.....	.95	2.00	2.40	1.55	1.45	1.78	2.20	2.40	1.58
30	1.02	.....	.85	2.05	2.28	1.58	1.40	1.75	2.15	2.45	1.52
31	1.00	.....	.95	.....	2.10	.....	1.35	1.65	.....	2.45	.....

Daily discharge, in second-feet, of South Platte River at Denver, Colo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	56	97	56	120	935	385	245	265	340	415	905
2	56	82	55	177	790	365	285	255	350	415	925
3	56	90	56	220	834	350	340	230	340	385	905
4	56	97	56	320	834	340	400	275	340	350	890
5	58	75	100	195	935	350	365	298	350	355	840
6	56	53	90	127	950	350	365	250	300	395	850
7	56	57	118	127	935	342	408	240	285	400	740
8	56	58	107	190	985	342	450	230	228	395	715
9	56	58	100	178	830	320	475	265	180	370	715
10	54	56	97	204	705	350	408	230	118	340	710
11	63	56	97	200	650	360	360	240	228	325	670
12	58	82	80	200	555	390	300	250	250	300	670
13	63	100	63	175	490	400	222	300	310	370	660
14	63	63	82	175	440	395	485	310	340	395	625
15	68	69	73	140	450	400	630	295	330	375	565
16	72	82	56	87	415	370	450	255	310	285	520
17	75	82	73	80	375	440	255	300	195	330	505
18	75	75	73	76	375	415	210	285	425	365	400
19	75	82	73	106	350	295	195	285	460	350	452
20	82	84	71	166	370	205	283	285	390	370	420
21	75	90	101	188	350	218	288	250	310	395	460
22	75	97	123	175	432	248	283	250	275	475	460
23	75	110	162	200	585	490	283	330	255	525	460
24	79	94	162	245	515	440	250	390	225	570	452
25	82	84	200	262	515	395	250	425	170	645	460
26	82	97	162	300	860	295	285	485	225	630	420
27	115	97	182	324	1,020	240	290	425	415	700	380
28	97	56	120	378	770	215	290	435	500	750	370
29	97	.....	95	423	660	260	240	375	595	795	365
30	100	.....	90	444	570	275	225	360	565	840	345
31	97	.....	97	.....	477	.....	210	320	.....	840	.....

NOTE.—The daily discharge was obtained by the indirect method for shifting channel conditions.

Monthly discharge of South Platte River at Denver, Colo., for 1906.

[Drainage area 3,840 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	115	54	71.9	4,420	0.019	0.02
February	110	53	79.4	4,410	.021	.02
March	200	55	99.0	6,090	.026	.03
April	444	76	207	12,300	.054	.06
May	1,020	350	644	39,600	.168	.19
June	490	205	341	20,300	.089	.10
July	630	195	323	19,900	.084	.10
August	485	230	302	18,600	.079	.09
September	595	118	320	19,000	.083	.09
October	840	285	469	28,800	.122	.14
November	925	345	597	35,500	.155	.17
The period				209,000		

NOTE.—Values for 1906 are good.

SOUTH PLATTE RIVER NEAR KERSEY, COLO.

This station was established April 7, 1901. It is located at a bridge about 1½ miles north of the railroad station at Kersey, which is on the Union Pacific Railroad about 6 miles east of Greeley, in T. 5 N., R. 64 W., and was intended to take the place of the station previously maintained at Orchard, Colo. The station was discontinued in the fall of 1903, but was reestablished March 5, 1905, to satisfy the demand for hydrographic data pertaining to the storage of flood waters. The station is below all the important tributaries of the South Platte which derive their supply from the mountain region and is at about the point where water could be used to best advantage for storage in reservoirs along the South Platte in northeastern Colorado. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 227, where are given also references to publications that contain data for previous years.

Discharge measurements of South Platte River near Kersey, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 23	M. C. Hinderlider	154	200	2.61	454
March 22	do.	161	229	2.85	540
March 27	do.	187	320	3.30	840
May 3	do.	242	609	4.35	1,850
June 22	do.	102	102	1.92	184
October 15	R. I. Meeker	225	358	3.08	740
November 5	do.	257	644	4.40	1,840

Daily gage height, in feet, of South Platte River near Kersey, Colo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	2.7	2.7	2.6	3.0	3.8	3.1	2.0	1.7	1.8	3.2	4.25
2	2.7	2.7	2.6	2.95	3.95	3.05	2.05	1.75	1.8	3.4	4.25
3	2.7	2.7	2.6	2.9	4.35	2.9	1.8	1.75	1.8	3.2	4.3
4	2.7	2.7	2.65	2.8	4.35	2.6	1.8	1.8	1.8	3.1	4.35
5	2.7	2.7	2.65	2.8	4.4	2.5	1.7	1.8	1.85	3.05	4.4

Daily gage height, in feet, of South Platte River near Kersey, Colo., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
6	2.7	2.7	2.7	2.8	4.4	2.4	2.0	1.75	1.95	3.0	4.1
7	2.7	2.7	2.7	2.8	4.55	2.1	2.0	1.7	2.0	3.1	4.3
8	2.7	2.7	2.7	3.0	4.4	1.7	2.0	1.7	2.2	3.2	4.28
9	2.7	2.65	2.7	3.2	4.2	1.7	2.0	1.7	2.2	3.2	4.28
10	2.7	2.65	2.75	3.6	4.2	1.7	2.35	1.7	2.2	3.3	4.22
11	2.7	2.6	2.75	3.5	4.05	1.7	2.8	1.7	2.2	3.2	4.12
12	2.7	2.6	2.75	3.3	4.0	1.7	2.3	1.7	2.2	3.1	3.98
13	2.7	2.6	2.75	3.25	4.2	1.7	2.0	1.75	2.4	3.0	3.98
14	2.7	2.65	2.75	3.1	4.0	1.6	1.95	1.75	2.4	3.0	3.98
15	2.7	2.65	2.75	3.0	4.0	3.0	2.1	1.75	2.4	3.0	3.98
16	2.7	2.65	2.7	2.95	3.9	2.8	3.3	1.75	2.55	3.0	3.75
17	2.7	2.65	2.7	2.85	3.5	2.5	3.7	1.7	2.65	2.95	3.75
18	2.7	2.65	2.65	2.8	3.5	2.7	3.6	1.7	2.7	2.95	3.75
19	2.7	2.65	2.6	2.85	3.4	2.6	3.6	1.7	2.8	2.9	3.75
20	2.7	2.65	2.7	2.9	2.7	2.3	3.3	1.7	2.8	2.9	3.75
21	2.7	2.65	2.8	2.95	2.3	2.0	2.8	1.7	3.1	3.0	3.75
22	2.7	2.65	2.85	3.1	2.3	1.95	2.3	1.75	3.4	3.8	3.7
23	2.75	2.6	3.0	3.1	2.3	1.95	2.2	1.75	3.35	3.9	3.7
24	2.75	2.6	3.2	3.1	2.3	2.3	2.0	1.75	3.3	3.95	3.7
25	2.75	2.6	3.25	3.1	2.7	2.3	2.0	1.75	3.25	4.0	3.7
26	2.75	2.6	3.3	3.2	3.5	3.3	1.8	1.8	3.25	4.0	3.7
27	2.75	2.6	3.3	3.5	3.8	2.8	1.7	1.8	3.2	4.0	3.7
28	2.75	2.6	3.25	4.0	3.6	2.55	1.7	1.8	3.2	4.1	3.7
29	2.75	.....	3.2	4.3	3.2	2.3	1.7	1.8	3.1	4.1	3.65
30	2.75	.....	3.2	4.1	3.2	2.05	1.7	1.8	3.1	4.5	3.6
31	2.7	.....	3.1	.....	3.2	.....	1.7	1.8	.....	4.25	.....

NOTE.—Floating ice January 1 to February 15.

Rating table for South Platte River near Kersey, Colo., from January 1 to December 31, 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.60	110	2.40	345	3.20	805	3.90	1,380
1.70	130	2.50	390	3.30	875	4.00	1,470
1.80	155	2.60	440	3.40	950	4.10	1,565
1.90	180	2.70	495	3.50	1,030	4.20	1,660
2.00	210	2.80	550	3.60	1,115	4.30	1,760
2.10	240	2.90	610	3.70	1,200	4.40	1,865
2.20	270	3.00	670	3.80	1,290	4.50	1,970
2.30	305	3.10	735				

NOTE.—The above table is applicable only for open-channel conditions. It is based on seven discharge measurements made during 1906 and is well defined between gage heights 1.9 feet and 4.5 feet.

Monthly discharge of South Platte River near Kersey, Colo., for 1906.

[Drainage area, 9,470 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	522	495	502	30,900	0.053	0.06
February	495	440	467	25,900	.049	.05
March	875	440	585	36,000	.062	.07
April	1,760	550	801	47,700	.085	.09
May	2,020	305	1,200	73,800	.127	.15
June	875	110	359	21,400	.038	.04
July	1,200	130	357	22,000	.038	.04
August	155	130	141	8,670	.015	.02
September	950	155	476	28,300	.050	.06
October	1,970	610	986	60,600	.104	.12
November	1,860	1,160	1,440	85,700	.152	.17
The period				441,000		

NOTE.—The plotting of the 1906 measurements appears to indicate that the conditions of flow for any given gage height remained constant, although it is known that radical changes in the channel at this station occurred about the middle of the year. Radical changes in the conditions of flow have taken place in previous years. Values are rated as follows: August, good; remainder of the year, excellent.

SOUTH PLATTE RIVER NEAR JULESBURG, COLO.

This station was established April 2, 1902. It is located at the wagon bridge crossing the South Platte about 1 mile southeast of Julesburg, Colo., a station at the junction of the main line and the Denver branch of the Union Pacific Railroad. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 229, where are given also references to publications that contain data for previous years.

As this is the last station on the South Platte in Colorado, and as it is also below all irrigation ditches taking water from the South Platte in Colorado with the exception of one, it is of considerable importance for obtaining data relative to the flow of return waters as well as to the natural flow of the main channel.

Discharge measurements of South Platte River near Julesburg, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 24	M. C. Hinderlider	618	427	1.90	918
March 30	do	823	530	2.20	1,200
June 23 [a]	do	[a] 139	[a] 52	1.48	71
November 6	R. I. Meeker	898	924	2.78	1,940

[a] Wading section.

Daily gage height, in feet, of South Platte River near Julesburg, Colo., for 1906.

Day.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.9		2.2	1.6	1.5	1.4				2.6
2	1.9		2.25	1.6	1.4		1.2	1.3	1.45	
3	1.9	1.9	2.2	1.6	1.45	1.4				
4	1.85	1.9	1.95	1.6	1.45		1.2	1.3	1.35	2.6
5	1.85	1.9	2.0	1.7	1.4	1.4				
6		1.9	1.95	1.75	1.4		1.2	1.1	1.45	2.6
7		2.2	1.95	2.0	1.35	1.35	1.45			
8	1.9	2.75	1.85	2.2	1.35			1.15	1.95	2.6
9	1.9	2.85	1.9	2.05	1.3	1.3	1.45			
10	1.9		1.9	2.05	1.35			1.15	1.95	2.6
11	1.9	2.7	1.9	2.05	1.3	1.4	1.25			2.5
12	2.2		1.9	2.05	1.4			1.4	1.95	2.75
13	2.75		2.5	2.0	1.35	1.35	1.25			
14			1.95	1.9	1.5			1.35	1.95	2.75
15			1.9	1.8	1.3	1.45	1.3			
16			1.8	1.75	1.3			1.35	1.95	2.75
17			1.9	1.6	1.3	1.35	1.3			
18			1.9	1.55	1.3			1.35	1.85	
19			1.95	1.5	1.3	1.35	1.2	1.35		
20			1.9	1.4	1.25			1.35	1.95	
21			1.85	1.35	1.2	1.35	1.15			
22			1.8	1.35	1.3			1.35	1.95	
23			1.8	1.5	1.45	1.3	1.15			
24	1.9		1.8	1.55	1.4			1.4	2.5	
25	1.9		1.8	1.7	1.4	1.3	1.15			
26	1.9		1.8	1.9	1.4			1.35	2.8	
27	1.85	2.25	1.8	1.9	1.4	1.35	1.15			
28	1.85	2.45	1.6	1.85	1.4			1.35	2.8	
29		2.25	1.6	1.7	1.4	1.3	1.15			
30		2.25	1.6	1.6	1.4			1.35	2.8	
31		2.25		1.55		1.3	1.2			

Rating table for South Platte River near Julesburg, Colo., for 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	7	1.70	165	2.30	825	2.90	2,330
1.20	14	1.80	230	2.40	1,000	3.00	2,700
1.30	28	1.90	310	2.50	1,200	3.10	3,090
1.40	48	2.00	410	2.60	1,430		
1.50	77	2.10	530	2.70	1,700		
1.60	115	2.20	670	2.80	2,000		

[a] The table was applied indirectly from February 1 to May 31.

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6, and is not well defined.

Monthly discharge of South Platte River near Julesburg, Colo., for 1906.

[Drainage area, 20,600 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
February (1-13; 24-28)	2,800	870	1,030	36,800	0.050	0.03
March (13 days)	3,120	920	1,580	40,700	.077	.04
April	1,800	210	636	37,800	.031	.03
May	880	50	302	18,600	.015	.02
June	77	14	42.6	2,530	.0021	.002
July	62	28	38.9	2,390	.0019	.002
August	62	10	21.1	1,300	.0010	.001
September	48	7	30.5	1,810	.0015	.002
October	2,000	38	679	41,800	.033	.04
November	1,850	1,200	1,550	49,200	.075	.04
The period				233,000		

NOTE.—The discharge was interpolated for missing gage heights. Values can not safely be considered as better than approximate, owing to shifting channel conditions and insufficient data.

CLEAR CREEK AT FORKSCREEK, COLO.

This station was established May 29, 1899. It is located at the United States Geological Survey bridge, just below the Colorado and Southern Railway bridge at the railroad station, in T. 33 S., R. 72 W. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 231, where are given also references to publications that contain data for previous years. The station is important because of its location above all diversions and also because of contemplated power development.

Discharge measurements of Clear Creek at Forkscreek, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 4	M. C. Hinderlider	28	19	2.20	49
May 7	T. E. Brick	35	52	3.22	227
May 26	M. C. Hinderlider	36	94	3.80	636
June 7	T. E. Brick	36	106	4.10	838
June 13	do	36	145	5.20	1,600
June 28	M. C. Hinderlider	36	111	4.10	712
August 18	R. I. Meeker	34	68	3.15	237
October 5	do	35	77	3.45	322
October 24	do	31	59	3.00	199

Daily gage height, in feet, of Clear Creek at Forkscreek, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	2.28	2.82	4.10	4.28	3.42	2.95	3.50	2.92
2	2.35	2.85	4.10	4.28	3.40	3.32	3.45	2.90
3	2.32	2.90	4.02	4.12	3.40	3.28	3.45	2.80
4	2.30	3.05	4.02	4.02	3.38	3.12	3.45	2.80
5	2.28	3.12	4.15	3.95	3.32	2.98	3.42	2.80
6	2.35	3.18	4.35	3.95	3.30	3.00	3.42	2.80
7	2.52	3.28	4.12	3.98	3.38	2.98	3.40	2.80
8	2.42	3.35	3.98	4.00	3.28	2.95	3.38	2.80
9	2.40	3.48	4.08	3.98	3.22	3.00	3.35	2.80
10	2.48	3.52	4.20	4.00	3.20	2.98	3.35	2.75
11	2.52	3.58	4.42	4.05	3.28	3.05	3.30	2.75
12	2.58	3.55	4.98	4.10	3.20	3.00	3.25	2.70
13	2.32	3.55	5.22	4.10	3.20	2.95	3.20	2.75
14	2.40	3.45	5.10	4.18	3.25	2.90	3.20	2.78
15	2.42	3.45	5.18	4.05	3.22	2.90	3.18	2.70
16	2.52	3.68	5.12	3.92	3.25	3.18	3.18	2.58
17	2.58	3.78	5.00	3.88	3.20	3.12	3.10	2.50
18	2.70	3.80	4.62	3.88	3.12	3.12	3.00	.....
19	2.65	3.88	4.50	3.90	3.05	3.10	3.00	.....
20	2.60	4.05	4.45	3.88	3.08	3.10	2.98	.....
21	2.70	4.02	4.42	3.82	3.25	3.10	2.95	.....
22	2.85	4.10	4.42	3.82	3.25	3.02	2.90	.....
23	2.98	4.20	4.42	3.80	3.35	3.10	2.90	.....
24	2.98	4.18	4.28	3.92	3.40	3.20	2.95	.....
25	2.90	4.08	4.08	3.72	3.25	3.25	3.00	.....
26	2.92	3.92	4.15	3.65	3.15	3.68	3.00	.....
27	2.92	3.92	4.15	3.60	3.12	3.60	2.98	.....
28	2.68	4.18	4.18	3.52	3.02	3.55	2.98	.....
29	2.72	4.22	4.12	3.55	3.00	3.48	3.00	.....
30	2.80	4.10	4.15	3.52	2.98	3.58	2.90	.....
31	.....	4.02	.....	3.48	2.98	.....	2.92	.....

Rating table for Clear Creek at Forkscreek, Colo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.20	49	3.00	183	3.80	545	4.60	1,370
2.30	59	3.10	213	3.90	620	4.70	1,505
2.40	71	3.20	245	4.00	705	4.80	1,645
2.50	85	3.30	280	4.10	795	4.90	1,785
2.60	100	3.40	320	4.20	895	5.00	1,930
2.70	117	3.50	365	4.30	1,000	5.10	2,080
2.80	135	3.60	415	4.40	1,115	5.20	2,230
2.90	157	3.70	475	4.50	1,240		

NOTE.—The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1906, and is fairly well defined.

Monthly discharge of Clear Creek at Forkscreek, Colo., for 1906.

[Drainage area, 345 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	178	57	102	6,070	0.296	0.33
May	916	139	510	31,400	1.48	1.71
June	2,260	688	1,170	69,600	3.39	3.78
July	979	356	638	39,200	1.85	2.13
August	329	178	256	15,700	.742	.86
September	463	157	238	14,200	.690	.77
October	365	157	240	14,800	.696	.80
November (1-17)	162	85	129	4,350	.374	.24
The period	.....	.....	.....	195,000	.....	.....

NOTE.—Values for 1906 are good.

PLATTE RIVER.

DESCRIPTION OF BASIN.

From the point of junction of North and South Platte rivers the main stream winds eastward across Nebraska, uniting with the Missouri at Plattsmouth, about 10 miles south of Omaha. Its course lies in the main through broad, level bottom lands, rather sandy in places, but for the most part fertile, bordered by bluffs varying in height from 50 to 300 or 400 feet. From its source to a point near Ashland, Saunders County, it is a broad, shallow stream, flowing in many places as a network of interlacing channels among numerous islands and sand bars, but father east it is confined between heavily wooded limestone bluffs.

The average annual precipitation is about 23 inches, of which 69 per cent falls during the five months of the growing season, from April to August; about half of the remainder is snowfall. The stream is subject to periodic floods, caused by the melting of snows in the headwaters regions of North and South Platte rivers; these floods reach a maximum in June and July and often do considerable damage to property on the lower portions of the stream. In the western part of the drainage area the waters of the river are extensively used for irrigation.

The Loup and its branches, which form the most important tributaries of the Platte, drain an area 13,540 square miles in extent, lying in the heart of Nebraska. The Loup proper is formed by the junction of North and Middle Loup rivers, which unite near the city of St. Paul, the Middle Loup in turn receiving the South Loup in the southwestern part of Howard County. The principal tributaries are Beaver, Cedar, Calamus, and Dismal creeks. A comparatively small amount of water is diverted for irrigation, the ditches generally being small and covering limited areas. A number of power plants are in operation and others of considerable extent have been proposed, particularly one near Columbus, by which it is believed that about 20,000 continuous horsepower may be developed.

PLATTE RIVER NEAR LEXINGTON, NEBR.

This station was established April 2, 1902. It is located at a highway bridge 3 miles south of Lexington, Nebr., in sec. 20, T. 9 N., R. 21 W. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 235, where are given also references to publications that contain data for previous years.

Discharge measurements of Platte River near Lexington, Nebr., in 1905-6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 1	G. W. Bates	3,720	1,420	3.50	2,470
May 16	do	3,790	5,050	4.25	13,800
June 12	H. C. Gardner	3,720	8,220	4.93	25,800
July 10	do	3,800	4,700	3.93	11,000
July 18	do	2,900	1,680	3.38	2,880
August 2	do	3,140	1,760	3.48	2,880
August 23	H. O. Smith				0
September 6	H. C. Gardner	1,480	637	3.25	990
September 20	F. S. Dobson	1,540	502	3.10	760
1906.					
April 10	F. S. Dobson	3,800	2,910	3.83	6,570
May 10	do		3,240	3.93	6,560
July 8	Arthur Dobson	3,770	2,550	3.83	4,910
July 31	do	3,620	1,180	3.52	2,040
September 8	A. R. Wilson		577	3.38	780
October 19	Arthur Dobson		923	3.40	1,540
November 10	do		2,490	3.78	4,920

Daily gage height, in feet, of Platte River near Lexington, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		3.97	4.27	3.85	3.45	3.30	3.37	3.81
2		3.97	4.42	3.72	3.40	3.35	3.35	3.92
3		4.00	4.44	3.80	3.45	3.35	3.35	3.92
4		4.00	4.47	3.81	3.57	3.40	3.45	3.94
5	3.82	3.95	4.47	3.82	3.61	3.40	3.40	3.95
6	3.82	3.98	4.50	3.87	3.65	3.40	3.42	3.90
7	3.77	4.02	4.50	3.80	3.60	3.35	3.44	3.77
8	3.80	3.97	4.42	3.83	3.50	3.37	3.45	3.80
9	3.82	3.92	4.17	3.72	3.47	3.33	3.45	3.80
10	3.87	3.95	4.11	3.67	3.40	3.30	3.42	3.81
11	3.95	3.95	4.05	3.57	3.40	3.25	3.42	3.86
12	3.87	3.85	3.97	3.60	3.34	3.42	3.42	3.90
13	3.80	3.82	3.95	3.60	3.27	3.45	3.45	3.85
14	3.82	3.80	4.00	3.55	3.22	3.52	3.46	3.80
15	3.87	3.82	4.05	3.56	3.20	3.50	3.47	3.80
16	3.92	3.85	4.02	3.57	3.17	3.44	3.37	3.66
17	3.85	3.75	3.97	3.55	3.20	3.37	3.50	3.80
18	3.80	3.77	3.92	3.55	3.20	3.37	3.45	3.75
19	3.80	3.72	3.87	3.55	3.15	3.40	3.50	3.70
20	3.80	3.80	3.90	3.60	3.10	3.42	3.52	3.60
21	3.85	3.87	3.85	3.62	3.07	3.45	3.52	3.60
22	3.84	4.00	4.05	3.60	3.02	3.47	3.52	3.48
23	3.82	4.00	4.07	3.57	3.00	3.46	3.57	3.32
24	3.75	4.02	4.10	3.55	3.10	3.45	3.55	3.32
25	3.72	4.07	4.12	3.55	3.25	3.40	3.52	3.46
26	3.70	4.20	4.15	3.65	3.30	3.42	3.55	3.60
27	3.80	4.16	4.10	3.60	3.35	3.40	3.55	3.65
28	3.87	4.12	4.07	3.55	3.42	3.42	3.75	3.60
29	3.95	4.55	4.02	3.52	3.27	3.40	3.95	3.42
30	3.96	4.15	3.97	3.50	3.27	3.38	3.77	3.25
31		4.20		3.52	3.25		3.90	

NOTE.—Sunday and holiday gage heights interpolated. Gage heights are the mean of the two gages.

Daily discharge, in second-feet, of Platte River near Lexington, Nebr., for 1905-6.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1905.							
1	.....	2,150	12,500	27,600	11,500	3,900	0
2	.....	2,600	12,500	27,600	15,600	2,900	300
3	.....	3,100	14,200	26,400	21,600	3,800	300
4	.....	3,400	14,700	25,200	17,800	3,400	300
5	.....	3,400	15,100	24,000	14,200	2,900	1,200
6	.....	3,400	15,100	20,300	11,600	2,200	990
7	.....	3,600	16,000	17,700	16,700	1,900	800
8	.....	3,250	17,000	16,500	14,000	1,900	800
9	.....	2,700	15,800	16,500	12,300	2,200	800
10	.....	2,100	16,100	21,400	11,000	2,500	600
11	.....	2,500	18,000	23,200	11,000	900	400
12	.....	2,300	20,300	25,200	9,600	700	500
13	.....	3,000	20,300	22,600	8,000	700	700
14	.....	2,850	18,400	20,700	7,200	800	500
15	.....	2,850	16,200	27,700	6,000	1,100	700
16	.....	2,850	13,800	30,000	5,500	600	1,600
17	.....	3,400	14,600	29,000	4,300	800	2,000
18	.....	3,650	13,800	28,000	3,200	100	2,300
19	.....	3,400	13,300	25,500	3,000	100	2,100
20	.....	3,400	14,000	24,300	3,200	100	1,900
21	.....	5,200	14,000	22,000	3,000	100	1,900
22	.....	6,300	14,000	19,400	4,700	100	2,000
23	.....	6,600	12,000	26,100	4,100	0	2,000
24	2,900	7,000	11,100	25,000	3,600	0	1,700
25	1,900	9,300	10,500	21,100	3,000	0	1,300
26	2,000	10,400	13,000	17,900	2,800	0	1,300
27	2,150	10,900	13,000	15,600	2,650	0	1,200
28	1,650	11,500	18,200	12,900	2,100	0	1,000
29	1,900	11,000	23,700	11,800	2,300	0	800
30	2,470	11,700	23,100	12,600	2,600	0	900
31	2,470	.....	24,500	.....	2,800	0	.....

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1906.								
1	.....	8,100	12,500	5,100	1,400	200	1,000	5,600
2	.....	8,100	15,500	3,600	1,000	600	900	7,100
3	.....	8,500	15,800	4,500	1,400	600	900	7,000
4	.....	8,500	16,400	4,600	2,400	900	1,600	7,200
5	6,500	7,700	16,400	4,700	2,800	900	1,200	7,400
6	6,500	8,200	17,000	5,400	3,000	900	1,600	6,700
7	5,800	8,800	17,000	4,500	2,700	600	1,700	5,000
8	6,100	7,500	15,400	4,900	1,800	700	1,800	5,200
9	6,500	6,800	10,500	3,600	1,600	500	1,800	5,200
10	7,200	7,200	9,400	3,100	1,000	250	1,600	5,300
11	8,500	7,200	8,400	2,100	1,000	100	1,600	6,000
12	7,100	5,800	7,100	2,600	600	1,100	1,600	6,500
13	6,200	5,400	6,800	2,600	100	1,300	1,800	5,800
14	6,400	5,200	7,500	2,100	0	1,900	1,900	5,200
15	6,800	5,400	8,400	2,200	0	1,800	2,000	5,200
16	7,600	5,800	7,900	2,300	0	1,400	1,300	3,600
17	6,600	4,500	7,000	2,100	0	900	2,400	5,200
18	6,000	4,800	6,300	2,200	0	900	2,000	4,600
19	6,000	4,000	5,500	2,200	0	1,100	2,400	4,000
20	6,000	4,900	6,000	2,600	0	1,300	2,700	2,900
21	6,600	5,900	5,300	2,800	0	1,500	2,700	2,900
22	6,500	7,700	8,100	2,600	0	1,700	2,700	1,800
23	6,100	7,700	8,500	2,400	0	1,600	2,900	600
24	5,000	8,000	9,000	2,200	0	1,500	2,700	600
25	4,600	8,900	9,300	2,200	100	1,100	2,400	1,700
26	4,400	11,100	9,900	3,200	200	1,400	2,700	3,000
27	5,600	10,400	9,000	2,700	600	1,200	2,700	3,400
28	6,600	9,700	8,500	2,300	1,100	1,400	4,800	3,000
29	7,700	18,000	7,800	2,000	100	1,200	7,600	1,300
30	8,000	10,200	7,000	1,900	100	1,100	5,000	200
31	.....	11,000	.....	2,000	100	.....	6,800	.....

NOTE.—The daily discharge was obtained by the indirect method for shifting channel conditions.

Monthly discharge of Platte River near Lexington, Nebr., for 1905–6.

[Drainage area, 53,300 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
1905.						
March (24–31)	2,900	1,650	2,180	34,600	0.041	0.01
April	11,700	2,100	4,990	297,000	.094	.10
May	24,500	10,500	15,800	972,000	.296	.34
June	30,000	11,800	22,100	1,320,000	.415	.46
July	21,600	2,100	7,770	478,000	.146	.17
August	3,900	0	1,090	67,000	.020	.02
September	2,300	0	1,100	65,500	.021	.02
The period				3,230,000		
1906.						
April (5–30)	8,500	4,400	6,420	331,000	.120	.12
May	18,000	4,000	7,770	478,000	.146	.17
June	17,000	5,300	9,970	593,000	.187	.21
July	5,400	1,900	3,010	185,000	.056	.06
August	3,000	0	745	45,800	.014	.02
September	1,900	100	1,060	63,100	.020	.02
October	7,600	900	2,480	152,000	.047	.05
November	7,400	200	4,210	251,000	.079	.09
The period				2,100,000		

NOTE.—Values are rated as follows: March, April, August, September, 1905, August and September, 1906, approximate; May to July, 1905, April to July, October and November, 1906, fair.

PLATTE RIVER NEAR COLUMBUS, NEBR.

This station was established June 4, 1895. It is located at the Meridian Bridge, about 3 miles south of Columbus, Nebr., in sec. 31, T. 17, R. 1 E. The bridge lies on the sixth principal meridian. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 237, where are given also references to publications that contain data for previous years.

Discharge measurements of Platte River near Columbus, Nebr., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 30	Geo. W. Bates	1,660	4,400	4.51	16,800
May 3	do	2,250	5,380	5.12	19,800
June 8	Arthur Dobson	2,300	4,570	4.52	13,800
July 13	do	2,007	1,550	2.90	2,880
August 28	do		40	1.24	51
September 29	do		386	1.88	524
October 27	do		1,540	2.98	3,100
November 24	do		960	2.65	2,150

Daily gage height, in feet, of Platte River near Columbus, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	5.1	3.9	4.15	2.75	0.85	1.9	2.7
2	.....	5.1	4.1	3.75	2.7	1.45	1.9	3.45
3	.....	5.15	4.1	3.7	2.65	1.55	1.85	3.45
4	.....	4.7	4.55	3.55	3.2	1.35	1.7	3.4
5	.....	4.4	4.55	3.45	3.0	1.35	1.65	3.55
6	.....	4.3	4.5	3.3	2.75	1.35	1.7	3.55
7	.....	4.1	4.45	3.2	3.25	1.35	1.7	3.6
8	3.75	3.8	4.65	3.15	3.05	1.4	1.65	3.6
9	3.65	3.8	4.45	3.05	3.0	1.65	1.65	3.5
10	3.6	3.75	4.4	2.95	3.15	1.7	1.75	3.5
11	3.6	3.7	4.1	2.9	2.95	1.6	1.9	3.3
12	3.65	3.65	3.9	2.8	3.0	1.65	1.9	3.3
13	3.8	3.55	3.75	2.9	2.8	1.65	1.85	3.45
14	4.2	3.5	3.6	2.85	2.6	2.05	1.9	3.3
15	3.95	3.35	3.55	2.75	2.6	2.75	1.95	3.3
16	3.65	3.35	3.5	2.7	2.25	2.35	2.1	3.3
17	3.7	3.25	3.65	2.65	2.5	2.6	2.25	3.15
18	3.6	3.2	4.0	3.2	1.95	2.7	2.4	3.1
19	3.45	3.2	3.75	2.8	1.65	2.75	2.45	3.1
20	3.35	3.2	3.85	2.8	1.35	2.5	2.45	3.0
21	3.0	3.15	3.55	2.65	1.35	2.4	2.4	.....
22	3.25	3.15	3.35	2.6	1.35	2.2	2.95	.....
23	3.4	3.05	3.3	2.6	1.35	2.2	3.4	.....
24	3.5	3.55	3.35	2.85	1.2	2.15	3.2	2.9
25	3.3	4.1	4.0	2.8	1.15	2.05	3.35	2.95
26	3.3	3.7	.....	2.75	1.35	2.05	3.35	2.95
27	3.45	3.8	4.5	2.15	1.25	2.15	3.0	2.9
28	3.8	3.1	4.15	2.95	1.05	2.05	3.0	2.9
29	4.5	3.05	3.95	3.05	1.05	1.9	2.7	2.9
30	4.3	3.85	4.0	3.0	1.0	1.9	2.55	3.2
31	.....	3.95	.....	3.0	0.9	.....	2.8	.....

Rating table for Platte River near Columbus, Nebr., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	5	1.80	500	2.80	2,580	3.80	7,370
0.90	10	1.90	630	2.90	2,900	3.90	8,090
1.00	15	2.00	770	3.00	3,240	4.00	8,860
1.10	25	2.10	930	3.10	3,620	4.20	10,580
1.20	40	2.20	1,110	3.20	4,040	4.40	12,540
1.30	70	2.30	1,310	3.30	4,490	4.60	14,800
1.40	120	2.40	1,530	3.40	4,970	4.80	17,490
1.50	190	2.50	1,770	3.50	5,500	5.00	20,600
1.60	280	2.60	2,020	3.60	6,080	5.20	24,100
1.70	380	2.70	2,290	3.70	6,700		

NOTE.—The above table is applicable only for open-channel conditions. It is based on eight discharge measurements made during 1906, and is well defined.

Monthly discharge of Platte River near Columbus, Nebr., for 1906.

[Drainage area, 56,900 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April (8-30)	13,600	3,240	6,530	298,000	0.115	0.10
May	23,200	3,430	8,180	503,000	.144	.17
June	15,400	4,490	9,220	549,000	.162	.18
July	10,100	1,020	3,480	214,000	.061	.07
August	4,260	10	1,580	97,200	.028	.03
September	2,440	8	846	50,300	.015	.02
October	4,970	330	1,640	101,000	.029	.03
November	6,080	2,290	4,080	243,000	.072	.08
The period	.....	.....	.....	2,060,000	.....	.....

NOTE.—Conditions of flow remained fairly constant during 1906. Values are rated as follows: April and May, fair; June to November, excellent.

LOUP RIVER AT COLUMBUS, NEBR.

This station was established October 13, 1894. It is located about 75 yards above the Union Pacific Railroad bridge and 6 miles above the mouth of the river, in sec. 23, T. 17 N., R. 1 W. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 240, where are given also references to publications that contain data for previous years.

Discharge measurements of Loup River at Columbus, Nebr., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 23	F. S. Dobson	.....	2,760	5.95	11,300
March 30	Geo. W. Bates	360	1,200	5.60	7,620
May 3	do	490	1,950	5.84	9,320
June 8	Arthur Dobson	530	1,110	4.39	2,760
July 13	do	527	897	4.25	2,250
August 28	do	.....	977	4.65	2,810
September 29	do	.....	1,090	4.49	2,690
October 27	do	210	764	4.63	3,760
November 24	do	.....	847	4.70	2,750

Daily gage height, in feet, of Loup River at Columbus, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	8.4	4.6	5.4	4.8	4.25	4.4	4.6
2	.....	6.55	4.4	4.75	4.7	4.3	4.35	4.65
3	.....	5.75	4.5	4.65	4.5	4.45	4.35	4.8
4	.....	5.75	4.5	4.35	4.85	4.4	4.4	4.9
5	.....	5.5	4.45	4.3	5.0	4.4	4.3	4.95
6	.....	5.0	4.5	4.25	4.9	4.4	4.3	4.95
7	.....	5.0	4.5	4.2	6.1	4.35	4.3	4.9
8	4.75	4.9	4.4	4.2	5.7	4.35	4.25	4.7
9	4.9	4.7	4.4	4.2	5.35	4.3	4.25	4.65
10	4.8	4.3	4.35	4.15	5.3	4.1	4.25	4.75
11	4.65	4.3	4.25	4.15	4.7	4.2	4.35	4.55
12	4.55	4.2	4.2	4.1	4.55	4.3	4.35	4.35
13	4.8	4.35	4.2	4.2	4.6	4.55	4.35	4.5
14	5.4	4.3	4.25	4.4	4.6	5.5	4.4	4.45
15	5.75	4.3	4.35	4.2	4.4	4.95	4.3	4.5
16	4.9	4.3	4.35	4.25	4.35	4.75	4.5	4.5
17	5.0	4.2	4.3	4.2	4.3	5.15	4.4	4.45
18	4.95	4.2	4.35	4.25	4.25	4.8	4.5	4.55
19	5.5	4.2	4.4	4.65	4.2	4.65	4.5	4.5
20	5.5	4.2	4.3	4.45	4.15	4.4	4.6	4.5
21	4.9	4.2	4.25	4.65	4.15	4.5	4.65	.....
22	4.85	4.3	4.25	4.4	4.05	4.45	5.05	.....
23	4.8	4.5	4.15	4.45	4.05	4.45	5.05	.....
24	4.8	4.55	4.25	4.45	4.05	4.5	5.3	4.7
25	4.75	5.1	4.4	4.35	4.1	4.5	5.0	4.7
26	4.8	4.75	.....	4.25	4.4	4.5	4.75	4.75
27	5.65	4.85	4.85	4.65	4.65	4.45	4.6	4.8
28	6.1	4.9	4.8	4.25	4.65	4.4	4.95	4.8
29	5.75	4.65	4.85	4.55	4.35	4.4	4.55	4.8
30	6.85	5.3	4.6	4.6	4.3	4.45	4.85	4.75
31	.....	4.8	.....	4.55	4.3	.....	4.75	.....

Daily discharge in second-feet, of Loup River at Columbus, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	25,000	3,400	7,900	4,000	1,400	2,300	3,300
2	.....	11,100	2,800	4,400	3,600	1,700	2,100	3,500
3	.....	8,700	3,000	3,900	2,700	2,200	2,200	4,100
4	.....	8,700	3,200	2,600	4,200	2,000	2,400	4,600
5	.....	7,200	3,000	2,400	5,000	2,000	2,100	4,900
6	.....	4,500	3,200	2,200	4,400	2,000	2,100	4,900
7	.....	4,500	3,200	2,100	11,600	1,800	2,100	4,600
8	3,650	4,300	2,800	2,100	9,000	1,800	1,900	3,400
9	3,950	3,400	2,800	2,100	6,600	1,700	1,900	3,200
10	3,500	1,900	2,600	1,900	6,200	1,100	2,000	3,600
11	2,900	1,900	2,200	1,900	3,300	1,400	2,400	2,700
12	2,500	1,500	2,000	1,700	2,700	1,700	2,400	2,000
13	3,600	2,000	2,000	2,100	2,900	2,700	2,400	2,500
14	6,600	1,800	2,200	2,800	2,900	7,400	2,500	2,400
15	8,700	1,800	2,600	2,100	2,100	4,400	2,200	2,200
16	4,000	1,800	2,600	2,200	1,900	3,500	2,900	2,200
17	4,500	1,600	2,400	2,100	1,800	5,400	2,500	2,000
18	4,200	1,600	2,600	2,200	1,600	3,700	3,100	2,400
19	7,200	1,600	2,800	3,600	1,400	3,400	3,100	2,200
20	7,200	1,600	2,400	2,800	1,300	2,200	3,500	2,200
21	4,000	1,600	2,200	3,600	1,300	2,600	3,700	.....
22	3,800	2,000	2,200	2,600	1,000	2,400	5,700	.....
23	3,600	2,700	1,900	2,800	1,000	2,400	5,700	.....
24	3,600	2,900	2,200	2,800	1,000	2,600	7,100	2,750
25	3,400	5,400	2,800	2,400	1,100	2,600	5,600	2,750
26	3,600	4,100	3,800	2,000	1,900	2,600	4,300	2,900
27	8,100	4,500	4,800	3,600	2,800	2,500	3,600	3,100
28	11,000	4,800	4,600	2,000	2,800	2,300	5,300	3,100
29	8,700	3,600	4,800	3,200	1,700	2,300	3,400	3,100
30	16,100	6,900	3,700	3,100	1,500	2,300	4,800	2,900
31	.....	4,300	.....	2,900	1,500	.....	4,300	.....

NOTE.—The daily discharge was obtained by the indirect method for shifting conditions of flow.

Monthly discharge of Loup River at Columbus, Nebr., for 1906.

[Drainage area, 13,500 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April (8–30)	16,100	2,500	5,580	255,000	0.413	0.35
May	25,000	1,500	4,590	282,000	.340	.39
June	4,800	1,900	2,890	172,000	.214	.24
July	7,900	1,700	2,780	171,000	.206	.24
August	11,600	1,000	3,120	192,000	.231	.27
September	7,400	1,100	2,600	155,000	.193	.22
October	7,100	1,900	3,280	202,000	.243	.28
November (27 days)	4,900	2,000	3,090	165,000	.229	.23
The period	.....	.....	.....	1,590,000	.....	.....

NOTE.—Considerable changes in the conditions of flow took place at this station during 1906. Values are rated as follows: April to July, fair; August to November approximate.

KANSAS RIVER DRAINAGE BASIN.

GENERAL FEATURES.

The drainage basin of Kansas River lies between the basins of the Platte and the Arkansas, entirely within the region of the Great Plains, and extends through the arid, semiarid, and humid regions. It extends from eastern Colorado to Missouri River, a distance of 485 miles.

The principal tributaries are Smoky Hill and Republican rivers, whose union forms Kansas River, and Blue River.

REPUBLICAN RIVER.

DESCRIPTION OF BASIN.

Republican River rises in the arid plains of eastern Colorado, flows northeastward into southwestern Nebraska, then eastward through the southern tier of counties to Superior, where it turns to the southeast, enters Kansas, and about 2 miles northeast of Junction unites with Smoky Hill River to form Kansas River. The length of the basin east and west is approximately 360 miles, its greatest width is 120 miles, and the total area drained is 25,840 square miles. The river is wide and rather shallow, with a rapid descent, and the bed is largely shifting quicksand of the most unstable character.

In the upper portion of its course the Republican receives many tributaries, chiefly from the south. Nearly all of these flow through a region where the rainfall is less than 22 inches; but as this part of the basin is covered with buffalo grass, which sheds rain like a roof, the per cent of rainfall reaching the streams is great. Near the mouth the drainage area is very narrow, and the tributaries are small and unimportant; but here the rainfall is 28 to 38 inches.

The Republican is subject to sudden rises and falls, and occasionally overflows its banks . The most notable flood since 1895, when the gaging station at Junction was established, occurred in May and June, 1903. This covered all the low bottom lands and washed away fences, houses, crops, railway tracks, bridges, stock, and everything movable.

Information in regard to the basin is contained in the following Annual Reports of the United States Geological Survey: Eighteenth, Part IV, page 194; Twenty-first, Part IV, page 219.

REPUBLICAN RIVER NEAR BOSTWICK, NEBR.

This station was established June 6, 1904. It is located at a highway bridge 1 mile south of Bostwick, Nebr., in sec. 23, T. 1 N., R. 8 W., and replaces a station established at Superior, Nebr., in 1895. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 244, where are given also references to publications that contain data for previous years.

Discharge measurements of Republican River near Bostwick, Nebr., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 7	F. S. Dobson	417	614	2.00	590
May 19	do		427	1.66	832
June 13	Arthur Dobson	196	237	1.05	391
July 19	do	415	150	.75	276
August 30	do	417	182	.84	267
October 13	do		107	.68	187

Daily gage height, in feet, of Republican River near Bostwick, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	3.9	1.55	.....	1.15	0.8	0.65	1.4
2	.....	4.95	1.5	.....	1.1	.8	.65	1.4
3	.....	4.15	1.5	.....	1.3	.75	.6	1.35
4	.....	3.85	1.5	.....	1.65	.75	.6	1.35
5	.....	2.75	1.45	.....	1.45	.7	.6	1.4
6	.....	2.55	1.45	.....	1.35	.65	.7	1.4
7	2.0	2.45	1.35	.....	1.25	.6	.75	1.4
8	2.15	2.65	1.3	1.15	1.15	.55	.8	1.4
9	2.05	2.55	1.25	1.05	1.15	.65	.75	1.4
10	1.95	2.45	1.25	1.0	2.1	.65	.7	1.4
11	1.95	2.3	1.15	.9	2.45	.9	.65	1.4
12	1.9	2.2	1.1	1.6	2.15	1.1	.65	1.4
13	2.15	2.1	1.05	.95	1.65	.75	.7	1.4
14	2.5	2.05	1.05	.9	1.5	.95	.7	1.4
15	2.35	2.0	1.0	.9	1.4	1.15	.75	1.4
16	2.15	1.95	1.0	.8	1.35	.85	.75	1.35
17	2.05	1.9	1.0	.75	1.2	.85	.8	1.35
18	2.0	1.85	.95	.7	1.15	.8	.8	1.4
19	1.95	1.8	.9	.7	1.05	.8	.85	1.4
20	1.95	1.65	.9	.8	1.0	.85	.9	1.35
21	1.95	1.6	.85	1.25	.9	.8	1.0	1.35
22	1.9	3.8	.85	2.95	.9	.8	1.35	1.3
23	1.9	2.6	.8	2.95	.9	.8	1.45	1.3
24	1.9	2.15	.8	2.6	1.1	.8	1.4	1.25
25	1.85	1.8	.8	2.25	1.1	.75	1.35	1.3
26	1.85	1.75	.85	2.15	.95	.75	1.45	1.35
27	2.0	1.55	.95	2.1	.9	.75	1.6	1.35
28	2.25	1.55	1.35	1.85	.85	.7	1.5	1.4
29	2.35	1.65	1.55	1.4	.85	.7	1.5	1.4
30	3.15	1.6	1.15	1.3	.85	.....	1.45	1.4
31	.....	1.55	.....	1.25	.8	.....	1.45	.....

Rating tables for Republican River near Bostwick, Nebr.

APRIL 7 TO 30, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.80	445	2.20	745	2.60	1,105	3.00	1,520
1.90	515	2.30	830	2.70	1,200	3.10	1,630
2.00	590	2.40	920	2.80	1,300	3.20	1,750
2.10	665	2.50	1,010	2.90	1,410		

MAY 1 TO NOVEMBER 30, 1906.[b]

0.60	170	1.60	790	2.60	1,750	3.60	2,970
.70	210	1.70	870	2.70	1,860	3.70	3,110
.80	260	1.80	960	2.80	1,970	3.80	3,250
.90	310	1.90	1,050	2.90	2,080	3.90	3,390
1.00	370	2.00	1,140	3.00	2,200	4.00	3,540
1.10	430	2.10	1,240	3.10	2,320	4.20	3,850
1.20	490	2.20	1,340	3.20	2,440	4.40	4,170
1.30	560	2.30	1,440	3.30	2,570	4.60	4,510
1.40	630	2.40	1,540	3.40	2,700	4.80	4,860
1.50	710	2.50	1,640	3.50	2,830	5.00	5,220

[a] This table is applicable only for open-channel conditions. It is based on one discharge measurement made during 1906 and the form of previous curves. It was assumed that a change in section occurred about May 1.

[b] This table is applicable only for open-channel conditions. It is based on five discharge measurements made during 1906 and the form of previous curves.

Monthly discharge of Republican River near Bostwick, Nebr., for 1906.

[Drainage area, 23,300 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April (7-30)	1,690	480	673	32,000	0.029	0.03
May	5,130	750	1,610	99,000	.069	.08
June	750	260	466	27,700	.020	.02
July (8-31)	2,140	210	736	35,000	.032	.03
August	1,590	260	553	34,000	.024	.03
September	460	150	253	15,100	.011	.01
October	790	170	371	22,100	.016	.02
November	630	525	610	36,300	.026	.03
The period				301,000		

NOTE.—Conditions of flow during April are very uncertain; during the remainder of the year they were probably constant. Values are rated as follows: April, approximate, or worse; May to November, probably good.

REPUBLICAN RIVER AT BENKELMAN, NEBR.

This station was established November 1, 1894, discontinued September 7, 1895, and reestablished May 20, 1903, some distance below the original location. It is located about one-half mile east of Benkelman, Nebr., on the line between secs. 17 and 20, T. 1 N., R. 37 W. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 247, where are given also references to publications that contain data for previous years.

Discharge measurements of Republican River at Benkelman, Nebr., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 11	F. S. Dobson		53	1.15	114
June 19	Arthur Dobson	143	34	1.00	40
August 25	do	153	44	1.12	64
September 22	do	154	54	1.15	74
November 30	do	94	158	1.10	122

Daily gage height, in feet, of Republican River at Benkelman, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.15	1.2	1.1	0.8	0.9	0.85	1.05	1.2
2	1.1	1.1	1.05	.85	.9	.9	1.05	1.3
3	1.1	1.1	1.05	.85	.9	.9	1.05	1.3
4	1.1	1.05	1.05	.....	.9	1.0	1.05	1.25
5	1.1	1.2	1.0	.8	1.0	.95	1.0	.....
6	1.05	1.2	.95	.8	1.1	.9	1.0	1.25
7	1.1	1.1	.9	.95	1.0	.9	1.05	1.2
8	1.1	1.25	.85	1.05	1.0	.85	1.05	1.2
9	1.1	1.25	.8	1.05	1.0	.85	1.05	.....
10	1.1	1.15	.8	1.05	1.0	.85	1.05	1.2
11	.....	1.15	.8	1.0	1.0	.....	1.1	1.2
12	.....	1.1	.8	1.0	1.0	.9	1.1	1.2
13	1.1	1.1	.8	.....	1.0	.9	.....	.....
14	1.15	1.1	.85	.8	.9	.....	.....	1.25
15	1.15	1.05	1.7	.8	.9	.....	1.05	1.25
16	1.15	1.05	.....	.8	.9	.9	1.15	1.25
17	.....	1.0	1.05	.8	.9	.95	1.2	1.3
18	1.2	1.0	1.0	.75	.8	1.0	1.05	1.2
19	1.2	.....	1.0	.7	.8	1.0	1.1	.....
20	1.2	.....	.85	.7	.8	1.1	1.1	.....
21	1.2	1.05	.8	.6	.8	1.1	.....	.....
22	1.2	1.05	.....	.5	.7	1.1	.....	.....
23	1.15	.....	1.0	.5	.....	1.1	.....	1.3
24	1.2	1.7	1.0	.7	1.1	1.1	.....	1.3
25	1.15	1.3	1.1	.5	1.1	1.25	1.2	1.3
26	1.1	1.1	.....	.....	.....	1.1	.....	1.1
27	1.9	1.1	.....	1.35	.95	1.05	1.2	1.2
28	1.6	1.0	.....	1.05	.85	1.0	1.15	.....
29	1.6	1.05	.85	.....	.85	1.0	1.15	1.1
30	.....	1.1	.8	.....	.....	1.0	1.15	1.1
31	.....	1.1	.....	.9	.9	.....	1.2	.....

NOTE.—Ice conditions November 17–30.

Daily discharge, in second-feet, of Republican River at Benkelman, Nebr., for 1905–6.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1905.								
1	.....	242	145	117	74	98	8	72
2	.....	262	130	95	102	72	8	72
3	.....	205	138	68	65	98	8	72
4	.....	154	138	58	42	85	22	72
5	.....	175	138	68	27	62	30	72
6	.....	160	138	58	40	98	45	72
7	.....	160	138	42	40	72	55	72
8	.....	175	160	27	57	60	45	60
9	.....	175	160	42	77	60	105	50
10	.....	192	160	74	77	60	105	72
11	.....	175	127	102	77	83	78	72
12	.....	167	127	87	50	110	55	72
13	.....	167	120	90	50	83	78	72
14	.....	167	103	55	40	60	77	72
15	.....	167	103	55	35	57	53	103
16	.....	167	103	65	35	57	77	72
17	.....	150	103	118	54	47	53	72
18	.....	150	108	90	47	47	77	72
19	237	142	138	65	32	37	103	72
20	217	157	108	55	58	37	103	72
21	165	175	122	55	72	37	77	85
22	105	157	108	103	86	35	72	103
23	130	270	97	55	72	10	72	85
24	130	328	142	55	72	10	50	85
25	115	230	142	42	67	10	72	85
26	148	178	127	55	67	15	72	85
27	165	145	127	55	67	35	72	103
28	165	162	117	42	136	10	72	112
29	122	178	182	42	136	10	50	142
30	93	162	148	42	310	6	50	176
31	170	.....	117	.....	125	3	.....	195

Daily discharge, in second-feet, of Republican River at Benkelman, Nebr., for 1905–6—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1906.								
1	115	130	78	10	24	17	57	122
2	102	102	67	17	24	24	57	150
3	102	102	67	17	24	24	57	150
4	102	88	67	13	24	42	57	150
5	102	130	56	10	42	32	47	150
6	88	130	42	10	62	24	47	150
7	102	102	36	32	42	24	67	135
8	102	145	24	51	42	17	67	135
9	102	145	17	51	42	17	67	135
10	102	115	17	51	42	17	67	135
11	102	115	14	42	42	20	78	135
12	102	100	14	42	42	24	78	135
13	102	100	14	26	42	24	74	142
14	115	100	20	10	24	24	70	150
15	115	113	263	10	24	24	67	150
16	115	113	160	10	24	24	93	150
17	122	67	57	10	24	32	105	167
18	130	67	47	4	10	42	67	147
19	130	74	47	2	10	42	78	163
20	130	74	17	2	10	62	78	163
21	130	80	10	1	10	62	100	163
22	130	75	26	0	2	62	100	163
23	115	185	42	0	32	70	100	180
24	130	295	42	2	62	70	100	180
25	115	145	62	0	66	108	122	180
26	102	87	40	64	48	70	122	117
27	398	82	40	128	32	57	122	147
28	275	59	40	51	17	47	105	132
29	275	70	17	38	17	47	105	117
30	200	82	10	37	20	47	105	117
31	.....	82	.....	24	24	.....	122	.....

NOTE.—The daily discharge was obtained by the indirect method for shifting channel conditions.

Monthly discharge of Republican River at Benkelman, Nebr., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
March (19–31)	237	93	151	3,800
April	328	142	183	10,900
May	182	97	129	7,930
June	118	27	65.9	3,920
July	310	27	73.8	4,530
August	110	3	50.5	3,110
September	105	8	61.5	3,600
October	195	50	86.9	5,340
The period	.....	.....	.....	43,300
1906.				
April	398	88	135	8,030
May	295	59	108	6,640
June	263	10	48.4	2,880
July	128	0	24.7	1,520
August	62	2	30.6	1,880
September	108	17	39.9	2,370
October	122	47	83.3	5,120
November	180	117	147	8,750
The period	.....	.....	.....	37,200

NOTE.—Owing to frequent radical changes in the conditions of flow at this station the above values can not safely be considered as better than approximate and in some instances may be even worse.

SOUTH FORK OF REPUBLICAN RIVER AT BENKELMAN, NEBR.

This station was established November 1, 1894, discontinued September 5, 1895, and reestablished May 20, 1903. It is located at the highway bridge about three-fourths of a mile east of Benkelman, on the line between secs. 17 and 20, T. 1 N., R. 37 W., and is about one-fourth mile above the mouth of the South Fork. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 248, where are given also references to publications that contain data for previous years.

Discharge measurements of South Fork of Republican River at Benkelman, Nebr., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 11	F. S. Dobson		49	1.50	75
June 19	Arthur Dobson	18	1.8	1.00	(a)
August 25	do				(b)
November 30	do	85	33	1.48	45

a Less than 1 second-foot. b Dry.

Daily gage height, in feet, of South Fork of Republican River at Benkelman, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.75	2.0	1.4	0.95	1.0	0.9	1.0	1.45
2	1.7	1.95	1.4	.95	1.0	.9	1.0	1.5
3	1.7	1.95	1.35	.95	1.0	.9	1.0	1.5
4	1.7	1.95	1.3		1.0	.9	1.0	1.5
5	1.6	1.9	1.25	.95	1.0	.9	1.0	
6	1.6	1.8	1.2	.95	1.0	.9	1.0	1.5
7	1.65	1.7	1.15	.95	1.0	.95	.95	1.45
8	1.6	1.7	1.1	.95	1.0	.95	1.0	1.45
9	1.6	1.7	1.05	.95	1.0	.95	.95	
10	1.55	1.6	1.05	.95	1.0	.95	1.0	1.5
11		1.5	1.0	.95	1.0	.95	1.0	1.5
12		1.5	1.0	.95	.9	.9	1.0	1.4
13	1.6	1.5	1.0		.9	.9		
14	1.6	1.5	1.0	.95	.9			1.45
15	1.6	1.5	1.0	.95	.9		1.0	1.45
16	1.5	1.5		.95	.9	.95	1.2	1.45
17		1.45	1.0	.95	.9	.95	1.2	1.5
18	1.6	1.4	1.0	.9	.9	1.0	1.2	1.5
19	1.6		1.0	.9	.9	1.0	1.25	
20	1.7		1.0	.9	1.0	1.0	1.25	
21	1.7	1.5	.95	.9	.9	.95		
22	1.7	1.45		.9	.9	1.0		
23	1.65		1.0	.9		.95	1.6	1.6
24	1.65	1.6	1.0	.9	1.0	1.0	1.5	1.5
25	1.7	1.6	1.0	.9		1.0	1.6	1.5
26	1.6	1.5				1.0		1.55
27	2.3	1.5		1.9	.95	1.0	1.6	1.55
28	2.3	1.5		1.2	.95	1.0	1.55	
29	2.2	1.45	1.0		.9	1.0	1.55	1.55
30		1.4	.95		.9	.95	1.55	1.5
31		1.4		1.1	.95		1.5	

Daily discharge, in second-feet, of South Fork of Republican River at Benkelman, Nebr., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	137	215	52	0	0	0	0	42
2	123	199	52	0	.....	.....	.....	48
3	123	199	43	0	.....	.....	.....	48
4	123	199	35	0	.....	.....	.....	48
5	96	183	28	0	0	0	0	48
6	96	152	21	0	.....	.....	.....	48
7	109	123	15	0	.....	.....	.....	42
8	96	123	10	0	.....	.....	.....	42
9	96	123	5	0	.....	.....	.....	45
10	84	96	5	0	0	0	0	48
11	88	73	0.5	0	.....	.....	.....	48
12	92	73	.5	0	.....	.....	.....	36
13	96	73	.5	0	.....	.....	.....	39
14	96	73	.5	0	.....	.....	.....	42
15	96	73	.5	0	0	0	0	42
16	73	73	.5	0	.....	.....	17	42
17	84	62	.5	0	.....	.....	17	48
18	96	52	.5	0	.....	.....	17	48
19	96	62	.5	0	.....	.....	21	50
20	123	62	.5	0	0	0	21	53
21	123	73	0	0	.....	.....	34	55
22	123	62	0	0	.....	.....	47	58
23	109	79	0	0	.....	.....	61	61
24	109	96	0	0			48	48
25	123	96	0	0	0	0	61	48
26	96	73	0	92	.....	.....	61	54
27	317	73	0	183	.....	.....	61	54
28	317	73	0	21	.....	.....	54	54
29	283	62	0	18	.....	.....	54	54
30	249	52	0	14	.....	0	54	48
31	.....	52	.....	10	0	.....	48	.....

NOTE.—A rating table was used April 1 to July 31. After that date the discharge was obtained by the indirect method for shifting conditions of flow.

Monthly discharge of South Fork of Republican River at Benkelman, Nebr., for 1906.

[Drainage area, 5,910 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	317	73	129	7,680	0.022	0.02
May	215	52	99.3	6,110	.017	.02
June	52	0	90.3	5,370	.015	.02
July	183	0	10.9	670	.0018	.002
August	0	0	0	0.0	.000	.000
September	0	0	0	0.0	.000	.000
October	61	0	21.8	1,340	.0037	.004
November	61	36	48.0	2,860	.0081	.01
The period	.....	.....	.....	24,000	.....	.....

NOTE.—Owing to frequent changes in the conditions of flow at this station and on account of insufficient number of discharge measurements the above values can not safely be considered as better than approximate and in many instances are probably worse.

KANSAS RIVER.

DESCRIPTION OF BASIN.

Kansas River as such is a comparatively short stream, being formed by the union of Smoky Hill and Republican rivers in Geary County, Kans., whence it flows eastward, entering the Missouri at Kansas City, Mo.

The most important feeder of the Kansas below the junction of Smoky Hill and Republican rivers is the Blue, which rises in southeastern Nebraska, flows to the southeast and south into Kansas, and joins Kansas River at Manhattan. The principal tributary of the Blue is the Little Blue, which rises in southern Nebraska, flows southeastward, and unites with the main stream near Blue Rapids.

Both the Kansas and the Blue have periods of high water nearly every year, but disastrous floods are rare. The most notable flood on record is that which occurred in May and June, 1903, when the water covered all the low bottom lands, destroying many lives and millions of dollars worth of property.

KANSAS RIVER AT LECOMPTON, KANS.

This station was established April 16, 1899. It is located at the new wagon bridge at Lecompton, Kans. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 259, where are given also references to publications that contain data for previous years.

Discharge measurements of Kansas River at Lecompton, Kans., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 26	E. C. Murphy	751	3,090	4.01	4,930
June 28	W. G. Russell	736	2,5.0	3.00	6,020

Daily gage height, in feet, of Kansas River at Lecompton, Kans., for 1906.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1	4.7	4.2	4.5	3.1	17	5.3	4.1	3.35	3.65
2	4.65	4.5	4.3	5.5	18	5.05	4.0	3.2	3.6
3	4.5	4.6	4.1	5.45	19	5.0	4.0	3.2	3.5
4	4.2	4.65	4.0	5.35	20	4.7	3.95	3.2	3.4
5	4.2	4.7	3.9	5.25	21	4.5	3.9	3.1	3.3
6	4.1	4.8	3.8	5.05	22	4.3	3.9	3.1	3.2
7	4.1	5.1	3.8	4.7	23	4.1	3.8	3.65	3.2
8	4.1	6.1	3.7	4.45	24	4.05	3.8	5.15	3.15
9	7.4	5.55	3.6	4.35	25	4.0	4.0	4.95	3.1
10	6.55	5.15	3.95	4.3	26	4.0	4.0	4.1	3.0
11	5.85	5.0	3.75	4.2	27	3.95	3.95	3.45	3.0
12	5.15	4.8	3.7	4.05	28	3.9	4.75	3.0	3.55
13	7.15	4.7	3.6	4.0	29	4.0	4.8	2.95	3.95
14	7.6	4.5	3.55	3.9	30	4.0	4.65	2.9	4.0
15	6.6	4.2	3.5	3.8	31	.....	4.6	.....	4.0
16	6.2	4.1	3.45	3.75					

GASCONADE RIVER DRAINAGE BASIN.

GASCONADE RIVER AT ARLINGTON, MO.

This station was established April 11, 1903, and was discontinued July 21, 1906. It was at first located about 2 miles below Arlington, on the right bank of the river, but owing to the impossibility of maintaining a cable across the river during high water the station was moved July 27, 1904, to the St. Louis and San Francisco railroad bridge, 1¼ miles upstream from the cable and one-fourth mile west of Arlington, Mo. The conditions at this station and the bench marks are described in Water-Supply Paper No. 172, page 266, where are given also references to publications that contain data for previous years.

Discharge measurements of Gasconade River at Arlington, Mo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 6	M. S. Brennan	366	1,630	5.17	3,730
May 11	do	351	1,140	3.92	1,780

Daily gage height, in feet, of Gasconade River at Arlington, Mo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	3.85	5.1	6.1	7.9	3.25	4.5	11.5
2	3.75	4.95	5.8	7.55	4.2	7.1	7.5
3	5.6	4.4	5.7	6.9	4.35	6.2	4.6
4	9.5	3.65	5.4	6.4	4.4	5.95	4.35
5	12.0	3.4	5.0	5.95	4.45	5.6	3.95
6	11.5	3.25	5.2	5.5	4.4	5.15	4.0
7	9.8	3.1	5.1	5.2	4.2	4.85	3.7
8	6.0	3.0	4.8	5.5	4.15	5.0	3.45
9	4.9	3.05	4.5	5.8	3.95	4.3	3.5
10	4.35	2.95	4.3	5.65	3.9	4.5	3.45
11	4.5	4.0	4.1	5.4	3.9	4.35	3.15
12	4.35	3.9	4.4	4.95	3.85	4.3	2.9
13	4.1	4.0	4.35	5.55	3.8	4.1	2.85
14	3.9	4.6	4.0	7.5	3.75	4.0	3.0
15	3.7	5.2	4.05	8.5	3.2	3.85	3.15
16	3.6	5.8	4.2	7.5	3.0	3.75	3.95
17	3.45	5.95	3.95	6.55	3.05	3.7	3.7
18	3.5	5.7	4.0	6.1	3.0	3.4	4.1
19	3.4	5.3	4.3	5.2	2.85	3.45	3.85
20	3.35	5.1	4.35	4.85	2.95	3.55	4.0
21	3.6	5.15	4.4	4.35	3.0	3.6	8.4
22	4.5	5.0	4.7	4.15	3.25	3.55	.....
23	8.4	5.15	5.0	4.2	3.3	3.3	.....
24	8.2	8.0	7.1	4.15	3.2	3.85	.....
25	6.5	9.2	11.55	3.85	3.3	4.6	.....
26	5.3	9.8	12.9	3.45	3.25	4.35	.....
27	4.85	7.3	11.8	3.3	3.15	4.0	.....
28	4.95	6.5	15.1	3.2	3.0	5.0	.....
29	5.6	.....	14.5	3.15	3.3	4.5	.....
30	5.8	.....	8.75	3.0	3.1	6.1	.....
31	5.4	.....	7.5	.....	3.4	.....	.....

Rating table for Gasconade River at Arlington, Mo., from July 26, 1904, to July 21, 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.80	630	4.20	2,340	5.60	5,130	8.00	10,400
2.90	700	4.30	2,520	5.70	5,340	8.20	10,860
3.00	780	4.40	2,710	5.80	5,560	8.40	11,320
3.10	870	4.50	2,900	5.90	5,780	8.60	11,780
3.20	965	4.60	3,100	6.00	6,000	8.80	12,240
3.30	1,060	4.70	3,300	6.20	6,440	9.00	12,700
3.40	1,160	4.80	3,500	6.40	6,880	10.00	15,050
3.50	1,270	4.90	3,700	6.60	7,320	11.00	17,500
3.60	1,390	5.00	3,900	6.80	7,760	12.00	20,100
3.70	1,520	5.10	4,100	7.00	8,200	13.00	22,800
3.80	1,660	5.20	4,300	7.20	8,640	14.00	25,600
3.90	1,820	5.30	4,500	7.40	9,080	15.00	28,400
4.00	1,990	5.40	4,710	7.60	9,520		
4.10	2,160	5.50	4,920	7.80	9,960		

NOTE.—The above table is applicable only for open-channel conditions. It is based on fourteen discharge measurements made during 1904-6, and is fairly well defined.

Monthly discharge of Gasconade River at Arlington, Mo., for 1906.

[Drainage area, 2,720 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	20,100	1,110	5,360	330,000	1.97	2.27
February	14,600	740	4,380	243,000	1.61	1.68
March	28,700	1,700	7,170	441,000	2.64	3.04
April	11,600	780	4,840	288,000	1.78	1.99
May	2,800	665	1,440	88,500	.529	.61
June	8,420	1,060	2,800	167,000	1.03	1.15
July 1-21	18,800	665	3,220	134,000	1.18	.92
The period				1,690,000		

NOTE.—Values for 1906 are good.

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CLASSIFICATION OF THE PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

[Water-Supply Paper No. 208.]

The publications of the United States Geological Survey consist of (1) Annual Reports; (2) Monographs; (3) Professional Papers; (4) Bulletins; (5) Mineral Resources; (6) Water-Supply and Irrigation Papers; (7) Topographic Atlas of United States, folios and separate sheets thereof; (8) Geologic Atlas of United States, folios thereof. The classes numbered 2, 7, and 8 are sold at cost of publication; the others are distributed free. A circular giving complete lists can be had on application.

Most of the above publications can be obtained or consulted in the following ways:

1. A limited number are delivered to the Director of the Survey, from whom they can be obtained, free of charge (except classes 2, 7, and 8), on application.

2. A certain number are delivered to Senators and Representatives in Congress, for distribution.

3. Other copies are deposited with the Superintendent of Documents, Washington, D. C., from whom they can be had at practically cost.

4. Copies of all Government publications are furnished to the principal public libraries in the large cities throughout the United States, where they can be consulted by those interested.

The Professional Papers, Bulletins, and Water-Supply Papers treat of a variety of subjects, and the total number issued is large. They have therefore been classified into the following series: A, Economic geology; B, Descriptive geology; C, Systematic geology and paleontology; D, Petrography and mineralogy; E, Chemistry and physics; F, Geography; G, Miscellaneous; H, Forestry; I, Irrigation; J, Water storage; K, Pumping water; L, Quality of water; M, General hydrographic investigations; N, Water power; O, Underground waters; P, Hydrographic progress reports.

Series P.—The hydrographic progress reports contain the results of stream measurements. A report is issued for every calendar year, containing the results of data collected during that year. These reports were first published as a part of the Director's annual report or as a bulletin; they are now published as water-supply and irrigation papers. The following is a list, by years, of the publications containing the progress reports of stream measurements (* means out of stock). A detailed index of these reports (1888–1903) is published as Water-Supply Paper No. 119.

1888. Tenth Annual Report, Part II*.
1889. Eleventh Annual Report, Part II*.
1890. Twelfth Annual Report, Part II*.
1891. Thirteenth Annual Report, Part III*.
1892. Fourteenth Annual Report, Part II*.
1893. Bulletin No. 131*.
1894. Bulletin No. 131*; Sixteenth Annual Report, Part II*.
1895. Bulletin No. 140*.
1896. Water-Supply Paper No. 11*; Eighteenth Annual Report, Part IV*.
1897. Water-Supply Papers Nos. 15* and 16*; Nineteenth Annual Report, Part IV*.
1898. Water-Supply Papers Nos. 27* and 28*; Twentieth Annual Report, Part IV*.
1899. Water-Supply Papers Nos. 35*, 36*, 37*, 38*, and 39*; Twenty-first Annual Report, Part IV*.

1900. Water-Supply Papers Nos. 47, 48, 49, 50, 51, and 52; Twenty-second Annual Report, Part IV.
1901. East of Mississippi River, Water-Supply Papers Nos. 65* and 75*.
West of Mississippi River, Water-Supply Papers Nos. 66 and 75*.
1902. East of Mississippi River, Water-Supply Papers Nos. 82 and 83.
West of Mississippi River, Water-Supply Papers Nos. 84 and 85.
1903. East of Mississippi River, Water-Supply Papers Nos. 97 and 98.
West of Mississippi River, Water-Supply Papers Nos. 99 and 100.
1904. East of Mississippi River, Water-Supply Papers Nos. 124, 125, 126, 127, 128, and 129.
West of Mississippi River, Water-Supply Papers Nos. 130, 131, 132, 133, 134, and 135.
1905. East of Mississippi River, Water-Supply Papers Nos. 165*, 166*, 167, 168*, 169, 170, and 171.
West of Mississippi River, Water-Supply Papers Nos. 171, 172*, 173*, 174, 175*, 176, 177, and 178.
1906. East of Mississippi River, Water-Supply Papers Nos. 201, 202, 203, 204, 205, 206, and 207.
West of Mississippi River, Water-Supply Papers Nos. 207, 208, 209, 210, 211, 212, 213, and 214.

Correspondence should be addressed to

The Director,
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Washington, D. C.

July, 1907.

O

Water-Supply and Irrigation Paper No. 209 Series P, Hydrographic Progress Reports, 63

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
CHARLES D. WALCOTT, DIRECTOR

SURFACE WATER SUPPLY OF LOWER WESTERN MISSISSIPPI RIVER DRAINAGE 1906

R. I. MEEKER AND J. M. GILES
DISTRICT HYDROGRAPHERS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1907

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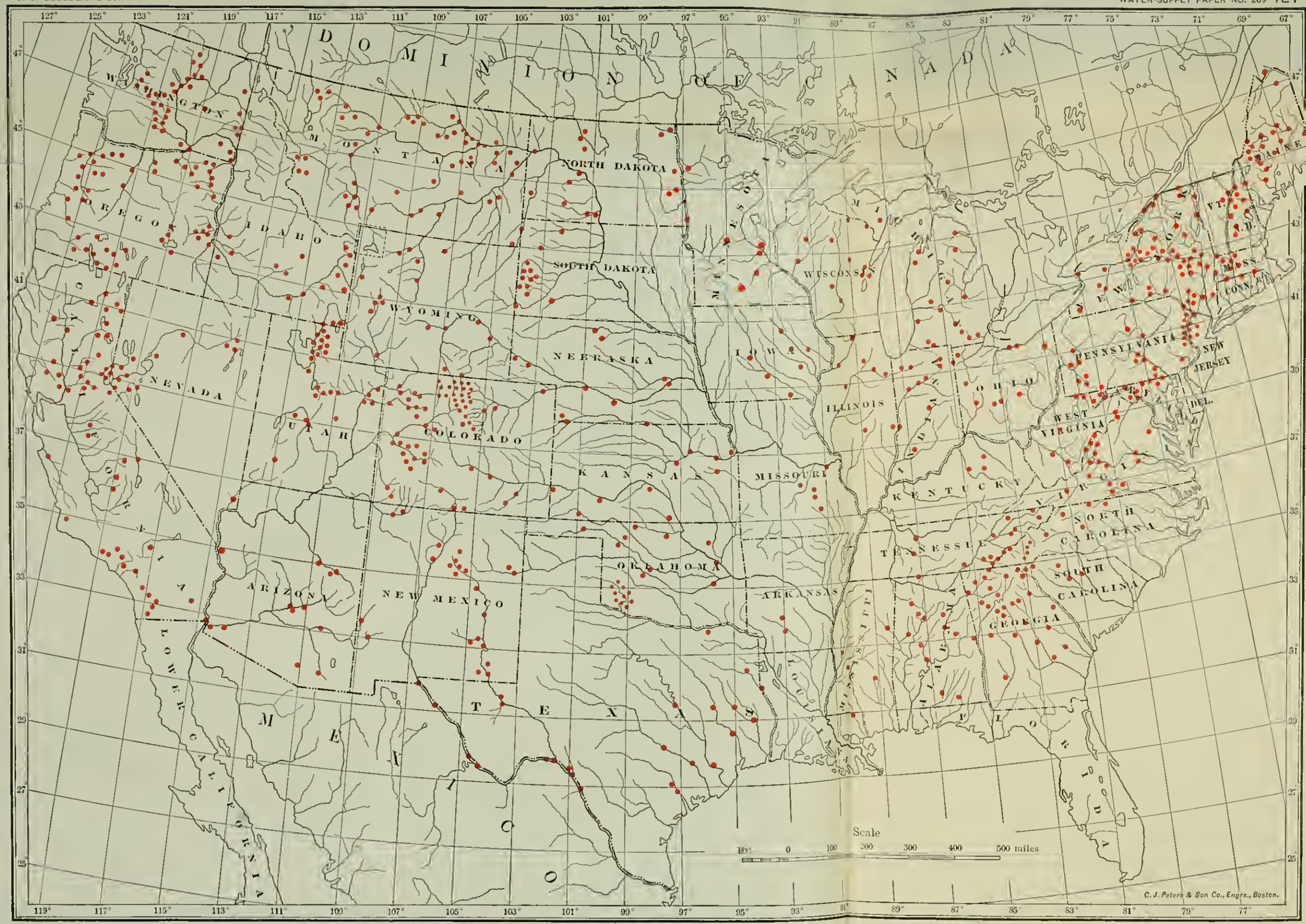


MAP OF UNITED STATES SHOWING LOCATION OF PRINCIPAL RIVER STATIONS MAINTAINED DURING 1906.

SURFACE WATER SUPPLY OF THE LOWER WESTERN MISSISSIPPI RIVER DRAINAGE, 1906.[a]

R. I. Meeker and J. M. Giles,
District Hydrographers.[b]

INTRODUCTION.

SCOPE OF WORK.

The water supply of the United States is of more importance to the life and pursuits of the people than is any other natural resource. In the arid States the limit of agricultural development is determined by the amount of water available for irrigation; while in all parts of the country the increase in the population of cities and towns makes necessary additional water supplies for domestic and industrial uses, in procuring which both the quantity and the quality of the water that may be obtained must be considered. The location of manufacturing plants may depend largely on the water-power facilities and on the character of the water. The notable advances made in the electric transmission of power have led to the utilization of water powers for the operation of manufacturing establishments, railroads, and municipal lighting plants, many of which are at some distance from the places at which the power is developed.

The intelligent establishment and maintenance of enterprises or industries that depend on the use of water demands a thorough knowledge of the flow of the streams and an understanding of the conditions affecting that flow. This knowledge should be based on data showing both the total flow and the distribution of the flow throughout the year, in order that normal fluctuations may be provided for. As the flow of a stream is variable from year to year, estimates of future flow can be made only from a study of observations

[a] This report contains information similar to that published in previous years under the title "Report on Progress of Stream Measurements."

[b] The data contained in this report were collected as follows:

In the southern portion of the territory the work was under the direction of J. M. Giles, assisted by W. A. Lamb, E. Patterson, and E. R. Kirby. In the northern and western portions the work was under the direction of M. C. Hinderlider during the first half of the year and under R. I. Meeker during the last half of the year.

The preparation of the data for publication was under the direction of John C. Hoyt, assisted by R. H. Bolster, F. F. Henshaw, Robert Follansbee, J. E. Stewart, and H. D. Padgett.

covering several years. The rapid increase in the development of the water resources of the United States has caused a great demand by engineers for information in regard to the flow of streams, as it is now generally realized that the failure of many large power, irrigation, and other projects has been due to the fact that the plans were made without sufficient trustworthy information in respect to the water supply.

Owing to the broad scope of these hydrographic investigations and the length of time they should cover in order that the records may be of greatest value, it is in general impossible for private individuals to collect the necessary data, and as many of the streams traverse more than one State this work does not properly fall within the province of the State authorities. The United States Geological Survey has therefore, by means of specific appropriations by Congress, for several years systematically made records of stream flow, with the view of ultimately determining all the important features governing the flow of the principal streams of the country. In carrying out this plan stations are established on the streams and maintained for a period long enough to show their regimen or general behavior. When a record that is sufficient for this purpose has been obtained for any stream the work on that stream is discontinued. The order in which the streams are measured is determined by the degree of their importance.

During 1906 the regimen of flow was studied at about 700 stations distributed along the various rivers throughout the United States, as shown on Pl. I. In addition to these records data in regard to precipitation, evaporation, water power, and river profiles were obtained in many sections of the country.

These data have been assembled by drainage areas, and are published in a series of fourteen Water-Supply and Irrigation Papers Nos. 201 to 214, inclusive, each of which pertains to the surface water resources of a group of adjacent areas. In these papers are embodied not only the data collected in the field, but also the results of computations based on these data, and other information that has a direct bearing on the subject, such as descriptions of basins and the streams draining them, utility of the water resources, etc. The list follows:

Water-Supply and Irrigation Papers on Surface Water Supply, 1906.

201. urface water supply of New England, 1906. (Atlantic Coast of New England drainage.)
202. Surface water supply of the Hudson, Passaic, Raritan, and Delaware river drainages, 1906.
203. Surface water supply of the Middle Atlantic States, 1906. (Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages.)
204. Surface water supply of the Southern Atlantic and Eastern Gulf States, 1906. (Santee, Savannah, Ogeechee, and Altamaha rivers and eastern Gulf of Mexico drainages.)

205. Surface water supply of the Ohio and lower eastern Mississippi river drainages, 1906.
206. Surface water supply of the Great Lakes and St. Lawrence River drainages, 1906.
207. Surface water supply of the upper Mississippi River and Hudson Bay drainage, 1906.
208. Surface water supply of the Missouri River drainage, 1906.
209. Surface water supply of the lower western Mississippi River drainage, 1906.
210. Surface water supply of the western Gulf of Mexico and Rio Grande drainages, 1906.
211. Surface water supply of the Colorado River drainage above Yuma, 1906.
212. Surface water supply of the Great Basin drainage, 1906.
213. Surface water supply of California, 1906. (The Great Basin and Pacific Ocean drainage in California, and Colorado River drainage below Yuma.)
214. Surface water supply of the North Pacific Coast drainages, 1906.

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing such records up to and including 1903 has been published in Water-Supply Paper No. 119. The following table gives, by years and primary drainage basins, the numbers of the papers on the surface water supply, published from 1901 to 1906.

Numbers of water-supply papers containing results of stream measurements, 1901–1906.[a]

	1901.	1902.	1903.	1904.	1905.	1906.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
Atlantic Coast of New England drainage	65 75	82	97	124	165	201
Hudson, Passaic, Raritan, and Delaware river drainages	65 75	82	97	125	166	202
Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages	65 75	82 83	97 98	126	167	203
Santee, Savannah, Ogeechee, and Altamaha river and eastern Gulf of Mexico drainages	65 75	83	98	126	168	204
Ohio and lower eastern Mississippi river drainages	65 75	83	98	128	169	205
Great Lakes and St. Lawrence River drainages	65	83	97	129	170	206
Hudson Bay and upper eastern and western Mississippi River drainages	65 66 75	83 84 85	98 99 100	128 130	171	207
Missouri River drainage	66 75	84	99	130 131	172	208
Meramec, Arkansas, Red, and lower western Mississippi river drainages	66 75	84	99	131	173	209
Western Gulf of Mexico and Rio Grande drainages	66 75	84	99	132	174	210
Colorado River drainage above Yuma	66 75	85	100	133	175	211
The Great Basin drainage	66 75	85	100	133	176	212
The Great Basin and Pacific Ocean drainages in California, and Colorado River drainage below Yuma	66 75	85	100	134	177	213
North Pacific Coast drainages	66 75	85	100	135	178	214

DEFINITIONS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups—(1) those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet

[a] Reports containing data for years prior to 1901 are noted in the series list at the end of this paper.

per square mile, and (2) those which represent the actual quantity of water, as run-off in depth in inches and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the quantity of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed.

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the quantity of water that passes through an orifice 1 inch square under a head which varies locally. It has been commonly used by miners and irrigators throughout the West and is defined by statute in each State in which it is used.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

"Acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. It is commonly used in connection with storage for irrigation work. There is a convenient relation between the second-foot and the acre-foot: One second-foot flowing for twenty-four hours will deliver 86,400 cubic feet, or approximately 2 acre-feet.

EXPLANATION AND USE OF TABLES.

For each regular gaging station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of monthly and yearly discharges and run-off.
6. Tables showing discharge and horsepower and the number of days during the year when the same are available.

The descriptions of stations give such general information about the locality and equipment as would enable the reader to find and use the station, and they also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge-measurement table gives the results of the discharge

measurements made during the year, including the date, the name of the hydrographer, the width and area of cross section, the gage height, and the discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage heights taken each day. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. At most stations the gage is read in the morning and in the evening.

The discharge measurements and gage heights are the base data from which the other tables are computed. In cases of extensive development, it is expected that engineers will use these original data in making their calculations, as the computations made by the Survey are based on the data available at the time they are made and should be reviewed and, if necessary, revised when additional data are available.

The rating table gives the discharge in second-feet, corresponding to various stages of the river, as given by the gage heights. It is published to enable engineers to determine the daily discharge in case this information is desired.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise, in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow for each second during the month. Upon this the computations for the remaining columns, which are defined on page 4, are based.

The values in the table of monthly discharge are intended to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates.

In most work where data in regard to flow are used the regimen of flow is of primary importance. Therefore for the principal stations tables have been prepared showing the horsepower that can be developed at various rates of flow and the length of time that these rates of flow and the corresponding horsepower are available. These tables have been prepared on a basis of 80 per cent efficiency on the turbines, and the horsepower per foot of fall is given in order that the reader can determine the horsepower for any fall.

In the computations sufficient significant figures have been used so that the percentage of error in the tables will not in general exceed 1 per cent. Therefore most of the values in the tables are given to

only three significant figures. In making the various computations Thatcher's slide rule, Crelle's tables, and computation machines have been generally used.

In order to give engineers an idea of the relative value of the various data, notes in regard to accuracy are given as far as possible. This accuracy depends on the general local conditions at the gaging stations and the amount of data collected. Every effort possible is made to so locate the stations that the data collected will give a high degree of accuracy. This is not always possible, but it is considered better to publish rough values with explanatory notes rather than no data.

In the accuracy notes the following terms have been used, indicating the probable accuracy in per cent of the mean monthly flow. As these values are mean values, the error in the value for the flow of any individual day may be much larger.

Excellent indicates that the mean monthly flow is probably accurate to within 5 per cent; good, to within 10 per cent; fair, to within 15 per cent; approximate, to within 25 per cent.

CONVENIENT EQUIVALENTS.

Following is a table of convenient equivalents for use in hydraulic computations:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second-foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equal 15.7 United States gallons per second.
100 California miner's inches equal 96.0 Colorado miner's inches.
100 California miner's inches for one day equal 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches equal 104 California miner's inches.
100 Colorado miner's inches for one day equal 5.17 acre-feet.
100 United States gallons per minute equal 0.223 second-foot.

100 United States gallons per minute for one day equal 0.442 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 22.95 acre-feet.
1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
$1\frac{1}{3}$ horsepower equal about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel, realizing 80 per cent of theoretical power.

FIELD METHODS OF MEASURING STREAM FLOW.

The methods used in collecting these data and in preparing them for publication are given in detail in Water-Supply Papers No. 94 (Hydrographic Manual, U. S. Geological Survey) and No. 95 (Accuracy of Stream Measurements). In order that those who use this report may readily become acquainted with the general methods employed, the following brief descriptions are given:

Streams may be divided, with respect to their physical conditions, into three classes—(1) those with permanent beds; (2) those with beds which change only during extreme low or high water; (3) those with constantly shifting beds. In determining the daily flow special methods are necessary for each class. The data upon which these determinations are based and the methods of collecting them are, however, in general the same.

There are three distinct methods of determining the flow of open-channel streams—(1) by measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir; (3) by measurements of the velocity of the current and the area of the cross section. The method chosen for any case depends upon the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to

the coefficients to be used in the Chezy formula, $v = c\sqrt{Rs}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The results obtained by the slope method are, in general, only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value for n to be used in Kutter's formula. The most common use of this method is in determining the flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions.

Weir methods.—When funds are available and the conditions are such that sharp-crested weirs can be erected, these offer the best facilities for determining the flow. If dams are suitably situated and constructed, they may be utilized for obtaining reliable measurements of flow. The conditions necessary to insure good results may be divided into two classes—(1) those relating to the physical characteristics of the dam itself and (2) those relating to the diversion and use of water around and through the dam.

The physical requirements are as follows: (*a*) Sufficient height of dam, so that backwater will not interfere with free fall over it; (*b*) absence of leaks of appreciable magnitude; (*c*) topography or abutments which confine the flow over the dam at high stages; (*d*) level crests, which are kept free from obstructions caused by floating logs or ice; (*e*) crests of a type for which the coefficients to be used in $Q = c\,b\,h^{\frac{3}{2}}$, or some similar standard weir formula are known (see Water-Supply Papers Nos. 180 and 200[a]); (*f*) either no flash boards or exceptional care in reducing leakage through them and in recording their condition.

Preferably there should be no diversion of water through or around the dam. Generally, however, the dam is built for purposes of power or navigation and part or all of the water flowing past it is diverted for such uses. This water is measured and added to that passing over the dam. To insure accuracy in such determinations of flow the amount of water diverted should be reasonably constant. Furthermore, it should be so diverted that it can be measured, either by a weir, a current meter, or a simple system of water wheels which are of standard make, or which have been rated as meters under working conditions, and so installed that the gate openings, the heads under which they work, and their angular velocities may be accurately observed.

The combination of physical conditions and uses of the water should be such that the determinations of flow will not involve, for a critical stage of considerable duration, the use of a head, on a broad-

[a] Water-Supply Paper No. 200 replaces No. 150, the edition of which has been exhausted.

crested dam, of less than 6 inches. Moreover, when all other conditions are good, the cooperation of the owners or operators of the plant is still essential if reliable results are to be obtained.

A gaging station at a weir or dam has the general advantage of continuity of record through the period of ice and floods and the disadvantages of uncertainty of coefficient to be used in the weir formula and of complications in the diversion and use of the water.

Velocity method.—The determination of the quantity of water flowing past a certain section of a stream at a given time is termed a discharge measurement. This quantity is the product of two factors—the mean velocity and the area of the cross section. The mean velocity is a function of surface slope, wetted perimeter, roughness of bed, and the channel conditions at, above, and below the gaging section. The area depends upon the contour of the bed and the fluctuations of the water surface. The two principal ways of measuring the velocity of a stream are by floats and current meters.

Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements in order that the data may have the required degree of accuracy. Their essential requirements are practically the same whether the velocity is determined by meters or floats. They are located as far as possible where the channel is straight both above and below the gaging section; where there are no cross currents, backwater, or boils; where the bed of the stream is reasonably free from large projections of a permanent character; and where the banks are high and subject to overflow only at flood stages. The station must be so far removed from the effects of tributary streams and of dams or other artificial obstructions that the gage height shall be an index of the discharge.

Certain permanent or semipermanent structures usually referred to as equipment are generally pertinent to a gaging station. These are a gage for determining the fluctuations of the water surface, bench marks to which the datum of the gage is referred, permanent marks on a bridge or a tagged line indicating the points of measurement, and, where the current is swift, some appliance (generally a secondary cable) to hold the meter in position in the water. As a rule, the stations are located at bridges if the channel conditions are satisfactory, as from them the observations can more readily be made and the cost of the equipment is small.

The floats in common use are the surface, subsurface, and tube or rod floats. A corked bottle with a flag in the top and weighted at the bottom makes one of the most satisfactory surface floats, as it is affected but little by wind. In case of flood measurements, good results can be obtained by observing the velocity of floating cakes of ice or débris. In case of all surface-float measurements, coefficients must be used to reduce the observed velocity to the mean velocity.

The subsurface and tube or rod floats are intended to give directly the mean velocity in the vertical. Tubes give excellent results when the channel conditions are good, as in canals.

In measuring velocity by a float, observation is made of the time taken by the float to pass over the "run," a selected stretch of river from 50 to 200 feet long. In each discharge measurement a large number of velocity determinations are made at different points across the stream, and from these observations the mean velocity for the whole section is determined. This may be done by plotting the mean positions of the floats as indicated by the distances from the bank as ordinates and the corresponding times as abscissas. A curve through these points shows the mean time of run at any point across the stream, and the mean time for the whole stream is obtained by dividing the area bounded by this curve and its axis by the width. The length of the run divided by the mean time gives the mean velocity.

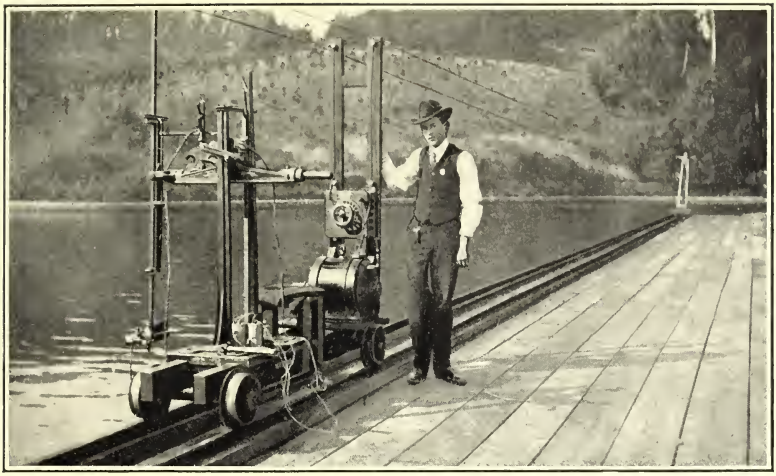
The area used in float measurements is the mean of the areas at the two ends of the run and at several intermediate sections.

The essential parts of the current meters in use are a wheel of some type, so constructed that the impact of flowing water causes it to revolve, and a device for recording or indicating the number of revolutions. The relation between the velocity of the moving water and the revolutions of the wheel is determined for each meter. This rating is done by drawing the meter through still water for a given distance at different speeds and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity per second for any number of revolutions.

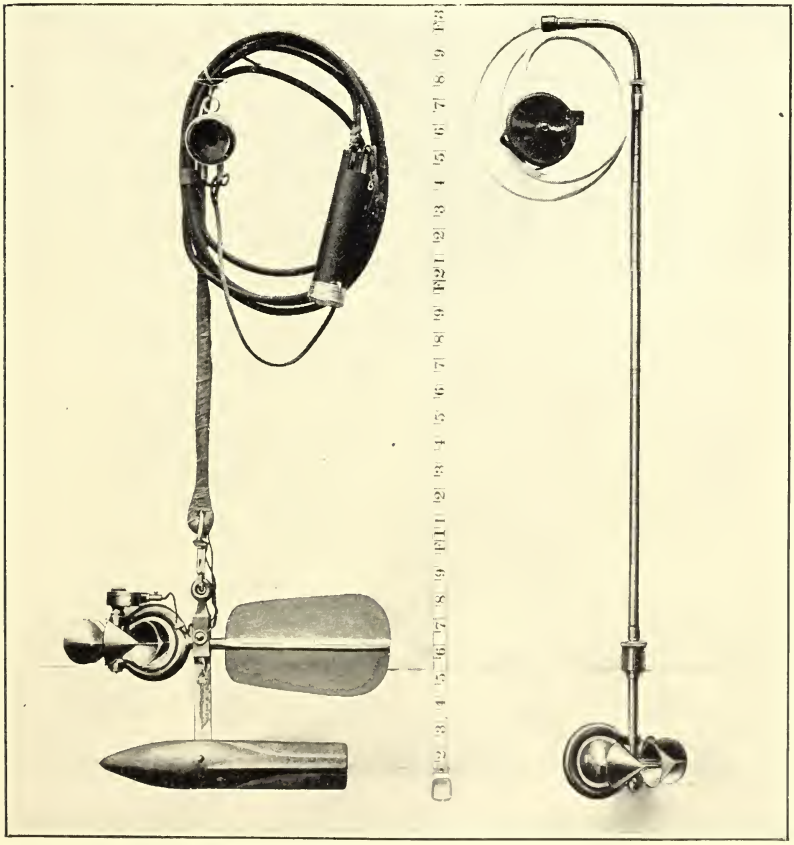
Many kinds of current meters have been constructed. They may, however, be classed in two general types: Those in which the wheel is made up of a series of cups, as the Price, and those having a screw propeller wheel, as the Haskell. Each meter has been developed for use under some special condition. In the case of the small Price meter, shown in Pl. II, *B*, which has been largely developed and has been extensively used by the United States Geological Survey, an attempt has been made to get an instrument which could be used under practically all conditions.

Current-meter measurements may be made from a bridge, a cable, a boat, or by wading, and gaging stations may be classified in accordance with such use. Fig. 1 shows a typical cable station.

In making the measurement an arbitrary number of points are laid off on a line perpendicular to the thread of the stream. The points at which the velocity and depth are observed are known as measuring points, and are usually fixed at regular intervals, varying from 2 to 20 feet, depending upon the size and condition of the stream. Perpendiculars dropped from the measuring points divide the gaging section into strips. For each strip or pair of strips the mean velocity,



A. CURRENT-METER RATING STATION AT LOS ANGELES, CAL.



B. PRICE CURRENT METERS.

area, and discharge are determined independently, so that conditions existing in one part of the stream may not be extended to parts where they do not apply.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

The three principal multiple-point methods in general use are the vertical velocity-curve; 0.2 and 0.8 depth; and top, bottom, and mid-depth.

In the vertical velocity-curve method a series of velocity determinations are made in each vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve among the resulting points, the vertical velocity-curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity-curve and its axis by the depth. On account of the length

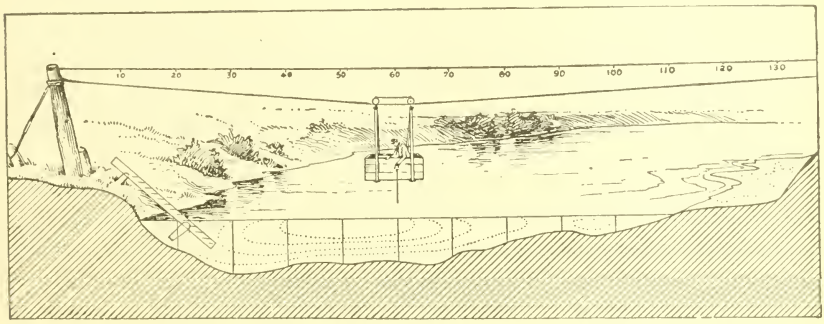


FIG. 1.—Cable station, showing section of river, car, gage, etc.

of time required to make a complete measurement by this method, its use is limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 of the depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity-curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 of the depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this second multiple-point method gives the mean velocity very closely for open-water conditions and, moreover, the indications are that it holds nearly as well for ice-covered rivers.

In the third multiple-point method the meter is held at mid-depth, at 0.5 foot below the surface, and at 0.5 foot above the bottom, and the mean velocity is determined by dividing by 6 the sum of the top

velocity, four times the mid-depth velocity, and the bottom velocity. This method may be modified by observing at 0.2, 0.6, and 0.8 depth.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined.

Extensive experiments by vertical velocity-curves show that the thread of mean velocity generally occurs at from 0.5 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, at which point the meter is held in a majority of the measurements. A large number of vertical velocity-curve measurements taken on many streams and under varying conditions show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be from 0.85 to 0.95, depending upon the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is especially adapted for flood measurements, or when the velocity is so great that the meter can not be kept at 0.6 depth.

The vertical-integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface, and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods.

The area, which is the other factor in the velocity method of determining the discharge of a stream, depends on the stage of the river, which is observed on the gage, and on the general contour of the bed of the stream, which is determined by soundings. The soundings are usually taken at each measuring point at the time of the discharge measurement, either by using the meter and cable or by a special sounding line or rod. For streams with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also of value in obtaining the area for use in computations of high-water measurements, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at various points of measurement, the measuring section is divided into elementary strips, as shown in fig. 1, and the

mean velocity, area, and discharge are determined separately for either a single or a double strip. The total discharge and the area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period, and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8, and vertical velocity-curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, the thickness and character of the ice, etc. From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice. For information in regard to flow under ice cover, see Water-Supply Paper No. 187.

OFFICE METHODS OF COMPUTING RUN-OFF.

There are two principal methods of determining run-off, depending upon whether or not the bed of the stream is permanent.

For stations on streams with permanent beds, the first step in computing the run-off is the construction of a rating table, which shows the discharge corresponding to any stage of the stream. This rating table is applied to the record of stage to determine the amount of water flowing. The construction of the rating table depends upon the method used in measuring flow.

For a station at a weir or dam, the basis for the rating table is some standard weir formula. The coefficients to be used in its application depend upon the type of dam and other conditions near its crest. After inserting in the weir formula the measured length of crest and assumed coefficient, the discharge is computed for various heads and the rating table constructed.

The data necessary for the construction of a rating table for a velocity-area station are the results of the discharge measurements, which include the record of stage of the river at the time of measurement, the area of the cross section, the mean velocity of the current, and the quantity of water flowing. A thorough knowledge of the conditions at and in the vicinity of the station is also necessary.

The construction of the rating table depends upon the following laws of flow for open, permanent channels: (1) The discharge will remain constant so long as conditions at or near the gaging station remain constant; (2) the discharge will be the same whenever the stream is at a given stage if the change of slope due to the rise and fall

of the stream be neglected; (3) the discharge is a function of and increases gradually with the stage.

The plotting of results of the various discharge measurements, using gage heights as ordinates, and discharge, mean velocity, and area as abscissas, will define curves which show the discharge, mean velocity, and area corresponding to any gage height. For the development of these curves there should be therefore a sufficient number of discharge measurements to cover the range of the stage of the stream. Fig. 2 shows a typical rating curve with its corresponding mean-velocity and area curves.

As the discharge is the product of two factors—the area and the mean velocity—any change in either factor will produce a corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate soundings extending to the limits of high water. It is always concave toward the horizontal axis or on a straight line, unless the banks of the stream are overhanging.

The form of the mean-velocity curve depends chiefly upon the surface slope, the roughness of the bed, and the cross section of the stream. Of these the slope is the principal factor. In accordance with the relative changes of these factors the curve may be either a straight line, convex or concave toward either axis, or a combination of the three. From a careful study of the conditions at any gaging station the form which the vertical velocity-curve will take can be predicted, and it may be extended with reasonable certainty to stages beyond the limits of actual measurements. Its principal use is in connection with the area curve in locating errors in discharge measurements and in constructing the rating table.

The discharge curve is defined primarily by the measurements of discharge, which are studied and weighted in accordance with the local conditions existing at the time of each measurement. The curve may, however, best be located between and beyond the measurements by means of curves of area and mean velocity. The discharge curve under normal conditions is concave toward the horizontal axis and is generally parabolic in form.

In the preparation of the rating table the discharge for each tenth or half tenth on the gage is taken from the curve. The differences between successive discharges are then taken and adjusted according to the law that they shall either be constant or increasing.

The determination of daily discharge of streams with changeable beds is a difficult problem. In case there is a weir or dam available, a condition which seldom exists on streams of this class, the discharge can be determined by its use. In case of velocity-area stations frequent discharge measurements must be made if the deter-

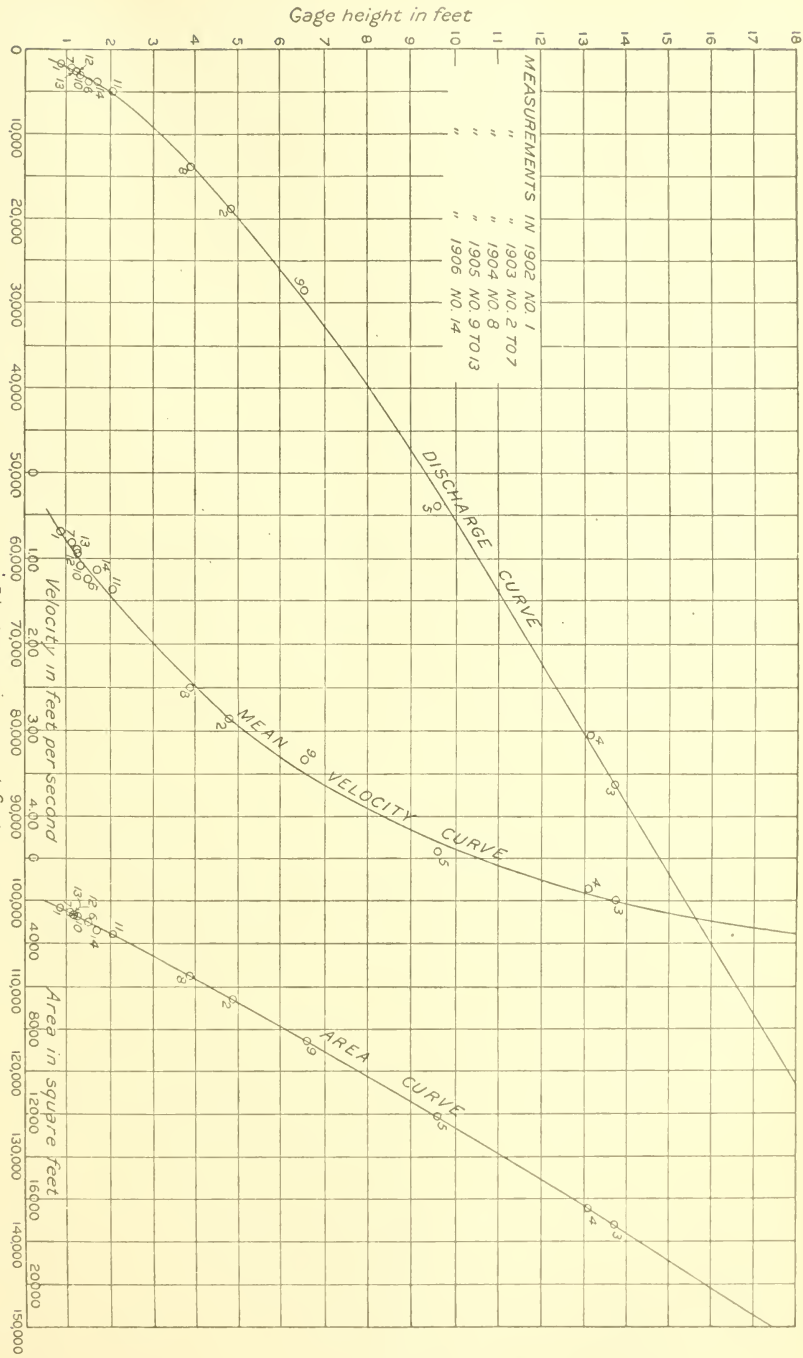


FIG. 2.—Discharge, area, and mean-velocity curves of Potomac River at Point of Rocks, Md.

minations of flow are to be other than rough approximations. For stations with beds which shift slowly or are materially changed only during floods, rating tables can be prepared for periods between such changes and satisfactory results obtained with a limited number of measurements, provided that some of them are taken soon after the change occurs. For streams with continually shifting beds, such as the Colorado and Rio Grande, discharge measurements should be made every two or three days and the discharge for intervening days obtained either by interpolation modified by gage height or by Professor Stout's method, which has been described in full in the Nineteenth Annual Report of the United States Geological Survey, Part IV, page 323, and in the Engineering News of April 21, 1904. This method, or a graphical application of it, is also much used in determining the flow at stations where the bed shifts but slowly.

COOPERATION AND ACKNOWLEDGMENTS.

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MERAMEC RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Meramec River rises in Dent County, Mo., flows northeast, and enters the Mississippi near St. Louis. This river drains a rugged, hilly, and comparatively thinly populated country. There are, however, numerous good sites for dams, and the United States Geological Survey is studying the river in connection with the possible water-power developments and for its possible use as a future water supply for the city of St. Louis.

The total drainage area of Meramec River is 3,619 square miles; at Eureka it is 3,500 square miles. The drainage area above Dry Fork is 340 square miles, and that of Dry Fork is 360 square miles.

MERAMEC RIVER NEAR MERAMEC, MO.

This station was established February 28, 1903, and was discontinued July 21, 1906. It was located about 600 feet below the mouth of Spring Branch and about 1 mile from the post road between Meramec and St. James, Mo. The conditions at the station and the bench marks are described in Water-Supply Paper No. 173, page 13, where are given also references to publications that contain data for previous years.

Discharge measurements of Meramec River near Meramec, Mo., in 1904–1906.

Date.	Hydrographer.	Gage height.	Discharge.
1904.		*Feet.*	*Sec.-ft.*
January 27	F. W. Hanna	3.33	390
March 8	do	3.22	322
April 13	do	4.05	585
June 14	Hanna and Murphy	3.10	281
July 27	F. W. Hanna	2.91	193
August 12	do	2.80	150
September 28	Hanna and Johnson	2.90	185
1905.			
June 22	M. S. Brennan	2.79	164
July 26	do	3.60	438
September 8	do	2.79	168
October 12	do	2.92	174
December 20	do	2.96	256
1906.			
March 7	M. S. Brennan	3.70	467
May 12	do	3.02	280

Daily gage height, in feet, of Meramec River near Meramec, Mo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	3.1	4.0	4.3	6.2	3.7	3.7	2.8
2	3.3	3.9	4.2	5.8	3.5	3.5	2.8
3	4.6	3.8	4.1	4.9	3.4	3.2	2.8
4	5.9	3.7	3.9	4.6	3.3	3.1	2.8
5	4.8	3.6	3.7	4.5	3.3	3.0	2.8
6	4.1	3.4	3.7	4.4	3.3	3.0	2.8
7	3.9	3.3	3.9	4.3	3.2	2.9	2.7
8	3.8	3.35	3.8	4.1	3.2	2.9	2.7
9	3.6	3.3	3.7	4.3	3.1	2.8	2.7
10	3.6	3.3	3.7	4.1	3.1	2.8	2.7
11	3.5	3.2	3.6	4.1	3.1	2.8	2.7
12	3.5	3.3	3.6	4.1	3.05	2.8	2.7
13	3.4	4.4	3.5	4.0	3.0	2.75	2.7
14	3.4	4.2	3.7	5.1	3.0	2.7	2.7
15	3.6	4.1	3.7	4.8	2.95	2.7	2.7
16	3.5	3.9	3.7	4.5	2.9	2.7	2.8
17	3.4	3.8	3.7	4.2	2.9	2.7	3.1
18	3.3	3.7	3.6	4.0	2.9	2.7	2.9
19	3.2	3.7	3.6	3.9	2.9	2.7	2.8
20	3.2	3.7	3.5	3.8	2.9	2.8	2.7
21	5.4	3.8	3.5	3.7	2.9	2.8	2.7
22	5.7	3.7	3.8	3.7	2.85	2.8	.....
23	7.6	3.7	4.6	3.6	2.8	2.8	.....
24	7.4	5.2	4.7	3.5	2.8	3.1	.....
25	6.0	4.8	5.0	3.4	2.8	3.2	.....
26	4.8	4.7	7.2	3.3	2.8	3.1	.....
27	4.4	4.5	8.9	3.3	2.8	3.0	.....
28	4.6	4.4	6.7	3.2	2.8	2.9	.....
29	4.6	.....	5.1	3.2	2.8	2.8	.....
30	4.4	.....	4.8	3.2	2.8	2.8	.....
31	4.3	.....	5.5	.....	2.8	.....	.....

Rating tables for Meramec River near Meramec, Mo.

FEBRUARY, 1903, TO JANUARY 20, 1904.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.40	134	2.50	165	3.00	329	4.00	732

JANUARY 21 TO JUNE 30, 1904, AND FROM MARCH 26 TO JULY 21, 1906.[b]

2.60	150	3.50	435	4.40	840	5.60	1,465
2.70	175	3.60	475	4.50	890	5.80	1,580
2.80	200	3.70	515	4.60	940	6.00	1,700
2.90	230	3.80	560	4.70	990	7.00	2,300
3.00	260	3.90	605	4.80	1,040	8.00	2,900
3.10	290	4.00	650	4.90	1,090	9.00	3,500
3.20	325	4.10	695	5.00	1,140		
3.30	360	4.20	740	5.20	1,245		
3.40	395	4.30	790	5.40	1,355		

JULY 1, 1904, TO MARCH 25, 1906.[c]

2.70	135	3.60	430	4.50	840	5.80	1,530
2.80	160	3.70	470	4.60	890	6.00	1,640
2.90	185	3.80	510	4.70	940	6.20	1,750
3.00	215	3.90	555	4.80	990	6.40	1,870
3.10	245	4.00	600	4.90	1,040	6.60	1,990
3.20	280	4.10	645	5.00	1,090	6.80	2,110
3.30	315	4.20	690	5.20	1,200	7.00	2,230
3.40	350	4.30	740	5.40	1,310	8.00	2,830
3.50	390	4.40	790	5.60	1,420		

[a] This table is based on discharge measurements made during 1903 and is well defined.

[b] This table is based on 3 discharge measurements made during 1904, 1 in 1906, and the form of the previous curve. It is not well defined.

[c] This table is based on 8 discharge measurements made during 1904–1906 and the form of previous curves. It is well defined below gage height 3.7 feet.

Monthly discharge of Meramec River near Meramec, Mo., for 1904–1906.

[Drainage area, 340 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
1904.						
January	2,180	134	424	26,100	1.25	1.44
February	435	150	229	13,200	.674	.73
March 1–24	695	260	363	17,300	1.07	.96
April 13–30	3,140	260	1,010	36,100	2.97	1.99
May	840	360	549	33,800	1.61	1.86
June	2,300	325	642	38,200	1.89	2.11
July	790	185	319	19,600	.938	1.08
August	430	160	215	13,200	.632	.73
September	185	160	172	10,200	.506	.56
October	390	148	189	11,600	.556	.64
November	160	148	155	9,220	.456	.51
December	148	148	148	9,100	.435	.50
The period				238,000		
1905.						
January	245	148	165	10,100	.485	.56
February	1,580	148	346	19,200	1.02	1.06
March	2,830	315	760	46,700	2.24	2.58
April	790	185	384	22,800	1.13	1.26
May	2,350	245	550	33,800	1.62	1.87
June	245	135	174	10,400	.512	.57
July	2,170	160	453	27,900	1.33	1.53
August	1,310	160	318	19,600	.935	1.08
September[a]	2,950	148	621	37,000	1.83	2.04
October	1,580	185	358	22,000	1.05	1.21

[a] Gage heights for September 14 and 15, 1905, in Water-Supply Paper No. 173, should be 2.8 feet.

Monthly discharge of Meramec River near Meramec, Mo., for 1904–1906—Continued.

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
1905.						
November	1,040	280	500	29,800	1.47	1.64
December	510	185	259	15,900	.762	.88
The year	2,950	135	407	295,000	1.20	16.28
1906.						
January	2,590	245	797	49,000	2.34	2.70
February	1,200	280	557	30,900	1.64	1.71
March	3,440	390	819	50,400	2.41	2.78
April	1,820	325	729	43,400	2.14	2.39
May	515	200	270	16,600	.794	.92
June	515	175	239	14,200	.703	.78
July 1–21	290	175	193	8,040	.568	.44
The period				213,000		

NOTE.—Values 1904 to 1906 are rated as good.

MERAMEC RIVER NEAR EUREKA, MO.

This station was established August 26, 1903, and was discontinued July 21, 1906. It was located at the highway bridge on the road between Crescent and Eureka, Mo., about 1½ miles from Eureka, 2 miles below the mouth of Big River, and 2 miles above the Frisco Railroad bridge. The conditions at the station and the bench marks are described in Water-Supply Paper No. 173, page 14, where are given also references to publications that contain data for previous years.

Discharge measurements of Meramec River near Eureka, Mo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 5	M. S. Brennan	270	1,520	8.48	7,210
May 9	Brennan and Lane	182	692	5.05	2,460

Daily gage height, in feet, of Meramec River near Eureka, Mo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	5.5	8.2	11.3	20.1	4.9	3.9	4.0
2	5.7	7.3	13.2	19.0	4.9	4.3	3.9
3	7.8	6.8	12.1	14.2	4.9	4.7	3.8
4	10.8	6.5	10.1	11.1	4.8	4.9	3.7
5	13.9	6.0	8.6	9.4	5.1	4.6	3.7
6	11.4	5.6	7.5	8.8	5.3	4.5	3.7
7	8.5	5.3	7.0	8.2	5.2	4.4	3.6
8	7.1	5.3	6.8	8.4	5.2	4.3	3.6
9	6.5	5.2	6.8	9.2	5.0	4.5	3.6
10	6.0	5.1	6.7	8.9	4.8	6.9	3.6
11	5.7	4.9	6.5	8.7	4.7	5.9	3.6
12	5.5	4.8	6.1	7.6	4.5	4.7	3.5
13	5.4	5.0	5.8	7.1	4.4	4.3	4.4
14	5.3	6.6	5.7	8.6	4.4	4.1	4.3
15	5.2	9.3	6.1	10.9	4.3	3.9	3.8

Daily gage height, in feet, of Meramec River near Eureka, Mo., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
16	5.2	8.2	6.2	10.5	4.2	3.8	5.8
17	5.2	7.4	6.1	8.5	4.1	3.7	5.2
18	5.1	6.6	5.8	7.5	4.1	4.2	5.0
19	5.0	6.1	5.8	6.9	4.0	7.4	4.2
20	4.9	6.0	5.6	6.5	4.0	5.5	4.0
21	6.9	6.5	5.5	6.3	4.0	4.4	3.8
22	12.6	7.1	7.2	6.0	4.0	4.3	.....
23	17.5	7.4	9.4	5.8	3.9	4.2	.....
24	18.4	11.8	10.0	5.6	3.9	4.1	.....
25	11.0	12.1	10.0	5.5	3.9	6.5	.....
26	9.4	14.0	12.7	5.3	3.8	5.6	.....
27	9.0	11.1	18.2	5.2	3.9	5.0	.....
28	9.3	11.2	21.2	5.1	3.8	4.7	.....
29	9.3	.....	20.4	5.0	3.8	4.5	.....
30	9.5	.....	16.1	5.0	3.7	4.4	.....
31	9.1	.....	19.3	.....	3.8	.....	.....

Rating table for Meramec River near Eureka, Mo., for 1903–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.60	460	4.20	1,520	5.80	3,150	8.80	6,700
2.70	490	4.30	1,610	5.90	3,260	9.00	6,960
2.80	530	4.40	1,700	6.00	3,370	10.00	8,330
2.90	580	4.50	1,790	6.20	3,590	11.00	9,790
3.00	640	4.60	1,880	6.40	3,810	12.00	11,340
3.10	710	4.70	1,980	6.60	4,030	13.00	13,090
3.20	780	4.80	2,080	6.80	4,250	14.00	15,040
3.30	850	4.90	2,180	7.00	4,470	15.00	17,040
3.40	920	5.00	2,280	7.20	4,710	16.00	19,040
3.50	990	5.10	2,380	7.40	4,950	17.00	21,040
3.60	1,060	5.20	2,490	7.60	5,190	18.00	23,040
3.70	1,130	5.30	2,600	7.80	5,430	19.00	25,040
3.80	1,200	5.40	2,710	8.00	5,670	20.00	27,040
3.90	1,280	5.50	2,820	8.20	5,920	21.00	29,140
4.00	1,360	5.60	2,930	8.40	6,180	22.00	31,240
4.10	1,440	5.70	3,040	8.60	6,440		

NOTE.—The above table is based on 22 discharge measurements made during 1903–1906 and is well defined between gage heights 2.8 feet and 6.2 feet.

Monthly discharge of Meramec River near Eureka, Mo., for 1906.

[Drainage area, 3,500 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	23,800	2,180	6,640	408,000	1.90	2.19
February	15,000	2,080	5,210	289,000	1.49	1.55
March	29,600	2,820	8,890	547,000	2.54	2.93
April	27,200	2,280	6,900	411,000	1.97	2.20
May	2,600	1,130	1,700	105,000	.486	.56
June	4,950	1,130	2,070	123,000	.591	.66
July 1–21	3,150	990	1,430	59,600	.409	.32
The period	.....	.....	.....	1,940,000	.....	.....

NOTE.—Values for 1906 are rated as good.

MERAMEC SPRING NEAR MERAMEC, MO.

This station was established February 28, 1903, and was discontinued July 21, 1906. It was located on Spring Branch, 500 feet from the spring, at a footbridge, about 1 mile from the mouth of Spring Branch and 2 miles above the mouth of Dry Fork. The conditions at the station and the bench marks are described in Water-Supply Paper No. 173, page 17, where are given also references to publications that contain data for previous years.

Discharge measurements of Meramec Spring near Meramec, Mo., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 15	S. K. Clapp	55	75	1.70	488
June 22	M. S. Brennan	27	41	.37	95
July 26	do	29	51	.95	203
September 8	do	27	42	.40	94
October 12	do	27	43	.52	113
December 20	do	27	41	.40	103
1906.					
March 7	M. S. Brennan	27	50	.90	202
May 12	do	27	45.6	.62	156

Daily gage height, in feet, of Meramec Spring near Meramec, Mo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	0.5	1.2	1.2	1.8	0.8	0.8	0.55
2	.5	1.1	1.1	1.8	.8	.6	.5
3	1.4	.95	1.0	1.8	.75	.65	.5
4	1.6	.9	.9	1.3	.75	.65	.5
5	1.8	.9	.9	1.2	.75	.6	.5
6	1.2	.85	.9	1.1	.8	.6	.5
7	1.0	.8	1.1	1.2	.75	.6	.5
8	.9	.75	1.0	1.2	.7	.55	.5
9	.8	.7	.95	1.1	.7	.55	.5
10	.8	.7	.95	1.2	.7	.5	.5
11	.8	.7	.9	1.0	.7	.5	.5
12	.7	.7	.9	1.0	.7	.5	.5
13	.7	1.3	.85	.95	.65	.5	.5
14	.7	1.2	.9	1.4	.6	.5	.5
15	.7	1.1	.9	1.4	.6	.5	.5
16	.7	1.0	.9	1.1	.6	.5	.5
17	.7	.95	.9	1.1	.6	.5	.5
18	.65	.9	.85	1.0	.6	.5	.5
19	.6	.8	.8	1.0	.55	.5	.5
20	.6	.8	.8	.95	.5	.5	.5
21	1.4	.9	.8	.9	.5	.5	.5
22	1.9	.9	.9	.9	.5	.5	.....
23	1.6	.9	1.2	.9	.5	.5	.....
24	1.4	1.4	1.3	.9	.5	.5	.....
25	1.3	1.3	1.3	.9	.5	.6	.....
26	1.1	1.2	1.9	.8	.5	.6	.....
27	1.1	1.3	2.3	.8	.5	.6	.....
28	1.3	1.3	1.9	.8	.5	.6	.....
29	1.3	.....	1.6	.8	.5	.6	.....
30	1.3	.....	1.5	.75	.5	.6	.....
31	1.25	.....	1.5	.....	.5	.....	.....

Rating table for Meramec Spring near Meramec, Mo., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.20	66	0.90	202	1.60	445	2.30	795
.30	80	1.00	228	1.70	490	2.40	850
.40	96	1.10	258	1.80	535	2.50	910
.50	114	1.20	290	1.90	580	2.60	970
.60	133	1.30	325	2.00	630	2.70	1,030
.70	154	1.40	360	2.10	685	2.80	1,100
.80	177	1.50	400	2.20	740		

NOTE.—The above table is based on 8 discharge measurements made during 1905–6 and is well defined between gage heights 0.35 foot and 1.7 feet.

Monthly discharge of Meramec Spring near Meramec, Mo., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
January	80	73	74.6	4,590
February	400	73	109	6,050
March	910	114	248	15,200
April	400	96	160	9,520
May	580	154	221	13,600
June	154	96	106	6,310
July	630	96	202	12,400
August	258	96	147	9,040
September	1,170	105	292	17,400
October	1,100	114	224	13,800
November	400	133	211	12,600
December	177	105	125	7,690
The year	1,170	73	177	128,000
1906.				
January	580	114	259	15,900
February	360	154	229	12,700
March	795	177	283	17,400
April	535	165	269	16,000
May	177	114	137	8,420
June	177	114	125	7,440
July 1–21	123	114	114	4,750
The period				82,600

NOTE.—Values for 1905–6 are rated as good.

COURTOIS CREEK AT SCOTIA, MO.

This station was established November 11, 1904, and was discontinued July 22, 1906. It was located at Scotia, a post-office 8 miles south of Leasburg, a small town on the St. Louis and San Francisco Railroad. The conditions at the station and the bench marks are described in Water-Supply Paper No. 173, page 18.

Discharge measurements of Courtois Creek at Scotia, Mo., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1904.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
November 1	F. W. Hanna			[a] 1.05	112
1905.					
April 9	M. S. Brennan	122	167	3.00	340
May 16	Sidney K. Clapp	120	227	4.10	746
June 23	M. S. Brennan	109	81	2.13	180
July 27	do	115	138	3.15	426
September 9	do	110	99	2.57	252
October 13	do	111	85	2.35	199
1906.					
March 8	M. S. Brennan	123	220	3.92	636
May 10	do	117	143	3.17	399

[a] Refers to original gage; gage height approximately 1.65 when referred to present gage.

Daily gage height, in feet, of Courtois Creek at Scotia, Mo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	2.25	4.75	4.75	(a)	3.3	2.8	2.6
2	2.25	4.75	2.95	4.9	3.3	2.8	2.6
3	2.25	4.75	2.75	4.8	3.2	2.8	2.5
4	2.25	4.75	3.75	(a)	3.2	4.3	2.5
5	2.25	4.75	3.75	5.9	3.2	3.9	2.5
6	5.95	4.65	3.55	5.9	3.1	3.3	2.5
7	5.95	4.35	3.35	5.7	3.1	3.1	2.9
8	5.35	4.35	3.35	5.4	3.1	2.9	2.9
9	3.95	4.15	3.25	5.3	3.1	2.9	2.7
10	3.15	4.15	3.25	4.6	3.1	2.8	2.7
11	3.25	4.15	3.25	4.5	3.1	2.8	2.7
12	3.25	3.75	3.15	4.3	3.1	2.8	2.6
13	3.35	3.75	3.15	4.3	3.1	2.8	2.6
14	3.45	3.65	3.05	5.7	3.1	2.7	2.6
15	3.45	3.65	2.95	4.9	3.1	2.7	2.5
16	3.45	3.95	2.95	4.8	3.1	2.7	2.5
17	3.35	3.95	2.95	4.7	3.1	2.7	2.5
18	2.95	3.95	3.75	4.7	3.1	2.7	2.5
19	2.95	3.95	3.75	4.7	3.0	2.7	2.4
20	2.95	3.75	3.55	4.6	3.0	2.7	2.4
21	2.95	*3.35	3.35	4.6	3.0	2.7	2.4
22	2.95	3.15	3.75	4.5	3.0	2.7	2.4
23	2.95	4.95	3.65	4.4	3.0	2.6	.....
24	3.75	4.95	3.65	4.4	2.9	2.6	.....
25	(a)	4.95	3.55	4.4	2.9	2.6	.....
26	(a)	3.95	4.95	3.7	2.9	2.6	.....
27	4.95	4.75	4.95	3.5	2.9	4.7	.....
28	4.95	4.75	4.75	3.5	2.9	2.9	.....
29	4.95	.....	4.75	3.5	2.8	2.8	.....
30	4.95	.....	(a)	3.3	2.8	2.7	.....
31	4.75	.....	(a)	.....	2.8	.....	.....

[a] Water over top of gage.

Rating table for Courtois Creek at Scotia, Mo., for 1905–6.

Gage height.	Discharge.	Gage height	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	50	2.10	170	3.20	410	4.60	945
1.10	58	2.20	186	3.30	440	4.80	1,040
1.20	66	2.30	202	3.40	470	5.00	1,140
1.30	75	2.40	218	3.50	500	5.20	1,245
1.40	85	2.50	235	3.60	535	5.40	1,355
1.50	95	2.60	255	3.70	570	5.60	1,465
1.60	105	2.70	275	3.80	610	5.80	1,580
1.70	116	2.80	300	3.90	650	6.00	1,700
1.80	128	2.90	325	4.00	690		
1.90	141	3.00	350	4.20	770		
2.00	155	3.10	380	4.40	855		

NOTE.—The above table is based on 8 discharge measurements made during 1905–6, and is well defined between gage heights 2.1 feet and 4.1 feet. Below gage height 2.0 feet it is very uncertain.

Monthly discharge of Courtois Creek at Scotia, Mo., for 1905—6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
January	535	105	219	13,500
February	1,190	50	302	16,800
March 1-23	2,690	255	806	33,600
April 10-30	1,580	155	487	20,300
May (30 days)	(a)	155	786	46,800
June	1,580	105	328	19,500
July (24 days)	(a)	58	459	21,800
August (29 days)	(a)	155	409	23,500
September (27 days)	(a)	50	386	20,700
October (29 days)	(a)	275	389	22,400
November	1,580	128	453	27,000
December	380	186	262	16,100
The period				282,000
1906.				
January (29 days)	(a)	194	622	35,800
February	1,120	395	802	44,500
March (29 days)	(a)	328	565	32,500
April (28 days)	(a)	440	984	54,600
May	440	300	365	22,400
June	990	255	347	20,600
July 1-22	325	218	250	10,900
The period				221,000

[a] Maximum discharge occurred on days when water was over gage.

NOTE.—Gage heights as published in Water-Supply Paper No. 173 for January, February, and March are approximately 0.75 foot too high as determined by the plotting of the 1904 discharge measurement. These gage heights were corrected before the application of the rating table. All values for this station are liable to large errors owing to frequent errors in gage readings.

ARKANSAS RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The western rim of the Arkansas basin is formed by three of the highest mountain ranges of Colorado—the Saguache, Sangre de Cristo, and Culebra, each having summits of more than 14,000 feet altitude. The melting of the almost perpetual snow which mantles the high peaks near the north end of this rim furnishes water for three small creeks, known, respectively, as East, Lake, and Tennessee forks, and these, uniting near Leadville, form the Arkansas.

From the junction of the forks the river flows a little east of south for about 75 miles, then turns to the east and cuts through a canyon whose perpendicular walls attain elevations of more than 2,000 feet above the water's edge, emerging finally into the plains region near Canyon. From Canyon to the Colorado-Kansas State line its general course is eastward for about 200 miles. Entering Kansas the river runs for 140 miles by general course a little south of east; it then makes a bold curve to the north, forming what is known as the Great Bend, below which it flows southeastward across Indian Territory to its junction with the Mississippi in northeastern Arkansas. The entire length of the stream from source to mouth, measured along the general course, is about 1,100 miles.

In its upper course the Arkansas is fed by numerous small streams, generally short, which lie wholly in or have their sources in the mountains. Those which head in the mountains and flow out onto the prairies are used more or less for irrigation. The most important of these tributaries are Greenhorn, Huerfano, Apishapa, and Purgatory rivers. The plains tributaries include Black Squirrel, Horse, Two Butte, and Big Sandy creeks, Salt Fork, Cimarron, Verdigris, Grand, and Canadian rivers, and scores of smaller streams. The largest of these is Canadian River.

The principal source of the water which the river bears to the plains is the precipitation along the crest of the high ranges. This is mainly in the form of snow and amounts to 20 or 30 inches each year. From the foothills to Arkansas City the precipitation ranges from 12 to 35 inches, being 25 to 35 inches in the last 100 miles below Hutchinson. The natural storage in the basin is limited to a few mountain lakes of gracial origin.

The streams of this drainage area are subject to floods of two kinds—the annual spring floods caused by the melting of the snows in the headwater regions; and floods caused by the violent storms, locally known as cloudbursts, in the foothills and plains regions. Occasionally, too, the river runs dry, and many of the tributaries are intermittent in character.

ARKANSAS RIVER.

ARKANSAS RIVER NEAR CANYON, COLO.

This station was established April 17, 1889, at the suspension footbridge at the Hot Springs Hotel, at Canyon, Colo., about 1 mile above the State penitentiary.

The station is of special importance, being located at the mouth of the canyon, at a point practically above the diversion of all water to the plains region, except the North and South Canyon ditches, both of which head above the station. During the irrigation season each of these ditches carries from 25 to 60 second-feet, according to the needs of the irrigators, and their discharge should be added to the discharge at the station in order to obtain the total run-off at the mouth of the canyon. No accurate records have been kept of the amount of water passing through these canals, although miscellaneous measurements have been made when measurements were made at the regular station. The estimated monthly discharges of Arkansas River at Canyon station do not include the water taken out by these canals. The conditions at the station and the bench marks are described in Water-Supply Paper No. 173, page 21, where are given also references to publications that contain data for previous years. The records cover a period of seventeen years.

Discharge measurements of Arkansas River near Canyon, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 17	R. I. Meeker	61	121	3.32	374
April 4	do	70	115	3.32	429
May 2	do	60	114	3.35	400
May 25	do	105	330	5.15	2,040
June 15	do	105	489	6.25	3,880
July 11	T. E. Brick	102	312	5.00	1,810
October 27	R. I. Meeker	80	178	3.95	697

Daily gage height, in feet, of Arkansas River near Canyon, Colo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	3.0	3.3	3.2	3.5	3.45	4.95	4.85	4.4	4.0	4.0	4.0
2	3.0	3.25	3.2	3.4	3.4	5.05	4.9	4.5	4.15	4.0	4.0
3	3.15	3.25	3.2	3.4	3.4	5.0	4.95	4.45	4.3	4.0	4.15
4	3.4	3.25	3.2	3.4	3.4	4.9	4.9	4.4	4.25	4.0	4.0
5	3.2	3.15	3.2	3.3	3.45	5.0	4.95	4.3	3.95	4.0	4.0
6	3.2	3.25	3.2	3.35	3.6	5.3	4.95	4.35	3.75	4.0	3.95
7	3.25	3.25	3.15	3.45	3.65	5.35	5.0	4.3	3.7	4.0	4.0
8	3.3	3.25	3.05	3.45	3.65	5.0	5.1	4.2	3.7	3.9	3.9
9	3.3	3.25	3.1	3.4	3.85	5.0	5.05	4.2	3.65	3.85	3.85
10	3.3	3.2	3.05	3.3	4.0	5.3	4.95	4.4	3.6	3.8	3.75
11	3.3	3.2	3.15	3.35	4.0	5.85	4.85	4.5	3.65	3.8	3.7
12	3.3	3.2	3.3	3.4	4.2	6.2	4.95	4.5	3.6	3.8	3.7
13	3.3	3.2	3.25	3.4	4.4	6.65	5.1	4.25	3.5	3.8	3.65
14	3.3	3.25	3.2	3.35	4.1	6.6	5.35	3.95	3.5	3.9	3.6
15	3.3	3.4	3.3	3.4	4.25	6.1	5.4	4.0	3.6	3.85	3.6
16	3.3	3.35	3.4	3.4	4.45	6.1	4.9	4.0	3.7	3.9	3.6
17	3.3	3.25	3.3	3.45	4.6	6.05	4.7	3.85	3.8	3.8	3.55
18	3.3	3.2	3.2	3.55	5.05	5.75	4.7	3.8	3.8	3.8	3.5
19	3.4	3.2	3.25	3.9	5.1	5.3	4.7	3.8	3.7	3.7	3.5
20	3.25	3.2	3.3	4.05	5.2	5.2	4.5	3.75	3.6	3.7	3.45
21	2.95	3.2	3.3	3.7	5.25	5.35	4.4	3.7	3.6	3.85	3.35
22	2.85	3.2	3.3	3.6	5.35	5.45	4.4	3.8	3.6	3.75	3.5
23	2.9	3.25	3.35	3.7	5.62	5.45	4.4	3.9	3.6	3.7	3.65
24	3.3	3.25	3.45	3.8	5.58	5.25	4.55	3.8	3.6	3.8	3.7
25	3.35	3.25	3.6	3.75	5.2	5.05	4.7	3.75	3.6	3.85	3.7
26	3.3	3.2	3.6	3.6	4.85	4.95	4.5	3.7	3.85	3.9	3.65
27	3.3	3.25	3.6	3.6	4.8	4.85	4.6	3.7	4.4	4.0	3.6
28	3.2	3.3	3.6	3.45	4.65	4.8	4.6	3.6	4.2	4.0	3.6
29	3.25	.....	3.5	3.65	4.8	4.75	4.5	3.7	4.05	4.0	3.65
30	3.2	.....	3.5	3.6	4.9	4.75	4.4	3.95	4.0	4.0	3.5
31	3.25	.....	3.4	.....	4.85	.....	4.35	4.0	.....	4.0	.....

NOTE.—From January 1 to February 12 there was some obstruction from slush ice. Discharges have been applied as for open channel.

Rating table for Arkansas River near Canyon, Colo.

JANUARY 1 TO JUNE 17, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.80	200	3.70	605	4.60	1,395	5.50	2,580
2.90	225	3.80	675	4.70	1,505	5.60	2,735
3.00	255	3.90	750	4.80	1,620	5.70	2,895
3.10	290	4.00	830	4.90	1,740	5.80	3,060
3.20	330	4.10	915	5.00	1,870	5.90	3,230
3.30	375	4.20	1,005	5.10	2,005	6.00	3,400
3.40	425	4.30	1,095	5.20	2,145	6.20	3,760
3.50	480	4.40	1,190	5.30	2,285	6.40	4,135
3.60	540	4.50	1,290	5.40	2,430	6.60	4,530

JUNE 18 TO NOVEMBER 30, 1906.[b]

3.30	280	4.10	825	4.90	1,685	5.70	2,870
3.40	330	4.20	915	5.00	1,815	5.80	3,040
3.50	385	4.30	1,010	5.10	1,950	5.90	3,220
3.60	445	4.40	1,110	5.20	2,090	6.00	3,400
3.70	510	4.50	1,215	5.30	2,235	6.10	3,580
3.80	580	4.60	1,325	5.40	2,385		
3.90	655	4.70	1,440	5.50	2,540		
4.00	740	4.80	1,560	5.60	2,700		

[a] This table is applicable only for open-channel conditions. It is based on 7 discharge measurements made during 1905-6 and is probably fairly accurate.

[b] This table is applicable only for open-channel conditions. It is based on 6 discharge measurements made during 1905-6 and is probably fairly accurate.

Monthly discharge of Arkansas River near Canyon, Colo., for 1906.

[Drainage area, 3,060 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	425	212	346	21,300	0.113	0.13
February	425	310	349	19,400	.114	.12
March	540	272	383	23,600	.125	.14
April	872	375	501	29,800	.164	.18
May	2,770	425	1,330	81,800	.435	.50
June	4,630	1,500	2,440	145,000	.797	.89
July	2,380	1,060	1,550	95,300	.500	.58
August	1,220	445	800	49,200	.261	.30
September	1,110	385	597	35,500	.195	.22
October	740	510	649	39,900	.212	.24
November	870	305	529	31,500	.173	.19
The period				572,000		

NOTE.—Values are rated as follows: January to April, good; May to November, excellent.

ARKANSAS RIVER AT PUEBLO, COLO.

The gaging station at Pueblo, Colo., was established in September, 1894, at the Santa Fe Avenue Bridge. Since that time continuous records have been kept up at various bridges for a period of eleven years. This station is important, being located near the head of the principal irrigated portion of Arkansas Valley and above the head-gates of the larger canals. For this reason water superintendents and commissioners depend on gagings made at this station for data by which distribution of the water is made to canals below. The conditions at the station and the bench marks are described in Water-Supply Paper No. 173, page 24, where are given also references to publications that contain data for previous years.

Discharge measurements of Arkansas River at Pueblo, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 18	R. I. Meeker	120	132	2.42	413
April 4	do	139	118	2.28	369
May 2	do	149	130	2.35	417
May 22	E. C. Murphy and R. I. Meeker	149	343	3.93	2,120
May 25	R. I. Meeker	149	392	4.15	2,420
June 15	do	150	627	5.60	4,550
June 15	do	150	582	5.28	3,940
July 11	T. E. Brick	150	306	3.50	1,700
October 6	R. I. Meeker	65	158	2.95	908

Daily gage height, in feet, of Arkansas River at Pueblo, Colo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	2.30	2.22	2.10	2.30	2.50	3.50	3.55	2.98	2.85	2.95	3.18
2	2.45	2.25	2.10	2.45	2.40	3.65	3.58	2.95	3.05	2.95	3.20
3	2.35	2.22	2.00	2.35	2.38	3.75	3.50	3.35	3.20	3.00	3.32
4	2.40	2.25	2.00	2.30	2.30	3.65	3.50	3.15	3.22	3.00	3.32
5	2.42	2.28	2.10	2.25	2.32	3.55	3.55	3.32	3.08	3.10	3.18
6	2.48	2.35	2.05	2.20	2.58	3.82	3.40	3.20	2.52	3.05	3.18
7	2.48	2.32	2.07	2.30	2.58	4.10	3.70	3.10	2.38	3.05	3.12
8	2.48	2.30	2.07	2.38	2.52	3.68	3.85	3.00	2.28	3.05	3.25
9	2.48	2.35	2.05	2.32	2.55	3.55	3.70	2.92	2.28	3.00	3.02
10	2.45	2.38	2.05	2.18	2.75	3.58	3.55	3.88	2.22	2.90	3.10
11	2.50	2.38	2.07	2.20	2.88	4.32	3.55	3.35	2.32	2.80	3.00
12	2.52	2.25	2.07	2.45	3.02	4.95	3.38	3.25	2.85	2.72	2.98
13	2.52	2.25	2.15	2.25	3.10	5.62	3.42	3.20	2.50	3.00	2.90
14	2.55	2.35	2.10	2.25	3.00	5.88	3.70	2.90	2.42	3.10	2.92
15	2.58	2.35	2.10	2.38	2.95	5.12	4.50	3.20	2.42	3.02	2.90
16	2.58	2.40	2.25	2.40	3.12	4.68	3.95	2.88	2.65	2.98	2.90
17	2.52	2.38	2.35	2.40	3.25	4.75	3.78	2.80	2.92	3.00	2.88
18	2.45	2.30	2.40	2.30	3.40	4.40	3.60	2.70	3.10	2.92	2.85
19	2.45	2.25	2.35	2.88	3.58	3.85	3.60	2.62	2.65	2.92	2.82
20	2.48	2.22	2.30	3.25	3.88	3.62	3.52	2.65	2.75	2.92	2.75
21	2.40	2.20	2.25	2.62	4.15	3.85	3.28	2.52	2.55	3.10	2.62
22	2.30	2.20	2.20	2.42	3.92	3.95	3.15	2.50	2.50	3.00	2.78
23	2.20	2.22	2.23	2.55	4.10	3.95	3.18	2.70	2.60	2.85	2.82
24	2.28	2.18	2.17	2.60	4.45	3.85	3.75	3.22	2.50	2.95	2.80
25	2.38	2.15	2.17	2.80	4.20	3.62	3.52	3.00	2.50	3.10	2.88
26	2.38	2.15	2.37	2.65	3.75	3.42	3.35	2.65	3.10	3.15	2.82
27	2.35	2.18	2.53	2.55	3.45	3.40	3.25	2.60	3.25	3.15	2.80
28	2.35	2.20	2.53	2.35	3.42	3.32	3.28	2.45	3.30	3.20	2.78
29	2.28	.....	2.50	2.42	3.38	3.30	3.22	2.45	3.15	3.20	2.82
30	2.25	.....	2.45	2.52	3.78	3.28	3.05	2.75	2.95	3.20	2.78
31	2.25	.....	2.37	.....	3.42	.....	3.02	2.80	.....	3.15	.....

NOTE.—From January 1 to March 20 there was some obstruction from slush ice; also from November 19 to 26. Discharges have been applied as for open channel.

Rating table for Arkansas River at Pueblo, Colo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec. ft.*	*Feet.*	*Sec.-ft.*
2.00	200	2.90	870	3.80	1,950	4.70	3,180
2.10	240	3.00	980	3.90	2,080	4.80	3,320
2.20	290	3.10	1,090	4.00	2,210	4.90	3,460
2.30	350	3.20	1,210	4.10	2,340	5.00	3,600
2.40	420	3.30	1,330	4.20	2,480	5.20	3,890
2.50	500	3.40	1,450	4.30	2,620	5.40	4,180
2.60	580	3.50	1,570	4.40	2,760	5.60	4,470
2.70	670	3.60	1,690	4.50	2,900	5.80	4,760
2.80	770	3.70	1,820	4.60	3,040	6.00	5,050

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905–6 and is fairly well defined.

Monthly discharge of Arkansas River at Pueblo, Colo., for 1906.

[Drainage area, 4,600 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	564	290	436	26,800	0.095	0.11
February	420	265	334	18,500	.073	.08
March	524	200	309	19,000	.067	.08
April	1,270	280	470	28,000	.102	.11
May	2,830	350	1,260	77,500	.274	.32
June	4,880	1,310	2,240	133,000	.487	.54
July	2,900	1,000	1,590	97,800	.346	.40
August	2,050	460	934	57,400	.203	.23
September	1,330	312	739	44,000	.161	.18
October	1,210	690	999	61,400	.217	.25
November	1,350	598	939	55,900	.204	.23
The period				619,000		

NOTE.—Values are rated as follows: January to April, good; May to November, excellent.

ARKANSAS RIVER NEAR SYRACUSE, KANS.

This station was established August 21, 1902, and was discontinued July 31, 1906. It was located on the highway bridge 1 mile south of Syracuse, Kans. The conditions and the bench marks are described in Water-Supply Paper No. 173, page 28, where are given also references to publications that contain data for previous years.

Discharge measurements of Arkansas River near Syracuse, Kans., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 19	T. E. Brick	50	25	2.00	23
June 4	W. G. Russell	39	14	1.80	12
June 26	do	145	74	2.10	80

Daily gage height, in feet, of Arkansas River near Syracuse, Kans., for 1906.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1	2.3	3.4	2.0	2.2	17	2.1	2.0	3.3	5.0
2	2.2	3.1	2.0	2.0	18	2.0	2.0	3.4	4.8
3	2.2	3.2	2.0	2.0	19	2.4	2.0	3.1	4.8
4	2.3	3.1	1.75	2.0	20	2.4	2.0	3.5	4.0
5	2.5	3.0	1.75	3.0	21	2.6	2.0	3.4	3.6
6	2.4	2.9	1.75	2.5	22	2.4	2.0	2.9	3.1
7	2.4	2.7	1.8	2.2	23	2.9	2.0	2.6	2.7
8	2.4	2.5	1.7	2.1	24	2.7	2.0	2.4	2.6
9	2.1	2.5	1.7	2.1	25	2.6	2.0	2.3	1.7
10	2.4	2.4	1.7	2.9	26	2.5	2.0	2.3	1.5
11	2.1	2.4	1.7	3.0	27	2.4	2.0	2.8	3.0
12	2.1	2.1	1.6	5.3	28	2.6	2.0	2.6	2.5
13	2.1	2.0	1.6	2.9	29	3.7	2.0	2.5	2.3
14	1.8	2.0	1.6	3.4	30	3.7	2.0	2.4	2.0
15	1.8	2.0	1.8	4.4	31	.....	2.0	.....	1.6
16	1.8	2.0	3.0	4.8					

ARKANSAS RIVER NEAR DODGE, KANS.

This station was established November 28, 1902, and was discontinued August 11, 1906. It was located one-fourth mile south of Dodge, on the highway bridge. The conditions at this station and the bench marks are described in Water-Supply Paper No. 173, page 30, where are given also references to publications that contain data for previous years. During 1906 discharge measurements were made from the Rock Island Railroad bridge, about one-half mile above the old highway bridge which had been torn down. A new gage was painted on the upstream side of the first cylinder pier from the south abutment of the new iron highway bridge. It reads from 0.8 to 7.0 feet, and is set at approximately the same datum as the old gage.

Discharge measurements of Arkansas River near Dodge, Kans., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 20	T. E. Brick	80	41	0.80	53
June 5	W. G. Russell	103	40	.90	60

Daily gage height, in feet, of Arkansas River near Dodge, Kans., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1	1.80	1.95	0.6	0.4	1.4	17	1.3	1.0	0.7	3.75	.....
2	1.7	2.5	.6	.4	1.0	18	1.3	.9	.8	4.0	.....
3	1.7	2.35	.8	.4	1.0	19	1.3	.9	.7	3.0	.....
4	1.6	2.15	.9	.3	1.0	20	1.4	.8	.9	3.0	.....
5	1.7	2.0	.75	.3	.9	21	1.6	.7	1.0	2.65	.....
6	1.75	1.95	.6	.3	.8	22	1.7	.7	.9	2.0	.....
7	1.7	1.9	.5	.3	.8	23	1.75	.6	1.2	1.9	.....
8	1.7	1.85	.5	.3	.8	24	1.75	.7	1.1	1.7	.....
9	1.7	1.8	.4	.3	.8	25	1.95	.85	1.0	1.65	.....
10	1.6	1.7	.4	.35	.8	26	1.85	.9	1.0	1.5	.....
11	1.5	1.6	.45	.4	.8	27	1.8	.8	1.0	1.6	.....
12	1.6	1.5	.4	.4	.....	28	1.8	.7	.95	1.6	.....
13	1.55	1.3	.4	.3	.....	29	1.7	.7	.9	1.8	.....
14	1.45	1.2	.4	.95	.....	30	1.6	.7	.75	1.6	.....
15	1.4	1.2	.4	1.55	.....	31	.....	.65	.....	1.5	.....
16	1.4	1.15	.4	1.45	.....						

ARKANSAS RIVER AT ARKANSAS CITY, KANS.

This station was established September 23, 1902, and was discontinued July 31, 1906. It was located on the Chestnut Avenue Bridge, one-half mile west of Arkansas City, Kans. The conditions at this station and the bench marks are described in Water-Supply Paper No. 173, page 34, where are given also references to publications that contain data for previous years.

Discharge measurements of Arkansas River at Arkansas City, Kans., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 17	W. G. Russell	241	557	4.30	836
May 21	T. E. Brick	183	198	3.30	304
June 6	W. G. Russell	235	261	3.50	444
June 27	do	106	75	2.55	97

Daily gage height, in feet, of Arkansas River at Arkansas City, Kans., for 1906.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1		5.3	3.5	2.9	17	4.3	3.4	3.3	3.5
2		5.3	3.4	3.5	18	4.3	3.5	3.3	3.3
3		5.4	3.5	3.3	19	4.2	3.4	3.3	3.1
4		5.5	3.4	3.1	20	4.0	3.5	2.8	4.0
5		4.0	3.5	3.6	21	3.8	3.3	2.8	5.2
6		4.0	3.5	3.3	22	4.0	3.2	2.6	4.1
7		3.8	3.5	3.3	23	3.8	3.3	2.5	5.4
8		3.5	3.4	3.1	24	3.7	3.8	3.0	5.5
9		3.5	3.3	3.1	25	3.6	3.7	3.0	5.2
10		3.5	5.4	3.3	26	3.5	3.5	2.9	4.9
11		3.4	5.0	3.6	27	3.5	3.6	2.5	4.7
12		3.7	5.5	4.1	28	3.4	3.4	2.8	4.2
13		3.7	4.8	3.5	29	3.4	3.3	2.6	4.0
14		3.4	4.0	3.6	30	4.4	3.3	2.5	4.0
15		3.5	3.8	3.5	31		3.2		3.9
16		3.4	3.3	3.3					

Rating table for Arkansas River at Arkansas City, Kans., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.50	90	3.30	330	4.10	725	4.90	1,240
2.60	105	3.40	375	4.20	780	5.00	1,320
2.70	125	3.50	420	4.30	835	5.10	1,410
2.80	150	3.60	465	4.40	895	5.20	1,500
2.90	180	3.70	515	4.50	960	5.30	1,600
3.00	210	3.80	565	4.60	1,025	5.40	1,700
3.10	245	3.90	615	4.70	1,095	5.50	1,800
3.20	285	4.00	670	4.80	1,165		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 4 discharge measurements made during 1906 and is well defined below gage height 4.3 feet.

Monthly discharge of Arkansas River at Arkansas City, Kans., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April (17–30)	895	375	647	18,000
May	1,800	285	589	36,200
June	1,800	90	454	27,000
July	1,800	180	642	39,500
The period				121,000

NOTE.—Values are rated as fair.

PURGATORY RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Purgatory River, a characteristic stream of eastern Colorado, is the principal tributary of Arkansas River in Colorado. It rises in the Culebra Mountains and flows northeastward across the plains for a distance of 165 miles. In the spring the channel carries a moderate volume of water, but as summer approaches this is greatly diminished by irrigation and natural conditions until the channel is practically dry. The volume of water contributed to the Arkansas is so small that it has no appreciable effect on the discharge of that river save at times of excessive rainfall, when it may discharge a large volume for a short time.

The drainage basin of Purgatory River is long and narrow. The total area is 3,386 square miles, of which 742 square miles, lying above Trinidad, are mountainous, the country being made up of shales, sandstones, and igneous rocks. This area is much broken by numerous stream channels, which are normally dry. The lower basin is largely foothill country, merging into rough plains farther east. Drainage lines are well defined throughout this area. For 60 miles of its length, commencing 25 miles below Trinidad, Purgatory River flows in a deep canyon. There are numerous small tributary canyons at various angles to the main channel.

In the mountainous portion the Weather Bureau records at Clearview for fifteen years give a mean annual rainfall of 23 inches; at Trinidad, ten years' record, 17 inches. The plains drainage has approximately a mean annual precipitation of 12 inches.

No storage is practiced on this stream, though investigations are being made by a corporation with the purpose of constructing a large storage reservoir for use in irrigation.

No power has been developed, and because of the abundance of coal in the vicinity of Trinidad it is doubtful if power development would be feasible, even under very favorable circumstances.

PURGATORY RIVER AT TRINIDAD, COLO.

This station was established May 1, 1896, at the Animas Street Bridge and was discontinued July 31, 1899, the greater portion of the water in the river being diverted above the gaging station; the channel was also shifting and results not satisfactory. July 25, 1905, the Trinidad station was reestablished at the old location on the Animas Street Bridge for the purpose of collecting general hydrographic data, especially flood data, and was maintained until December 31,

1905. It was reestablished November 1, 1906, to take the place of the station near Alfalfa, which had been discontinued for the winter. The conditions at this station and the bench marks are described in Water-Supply Paper No. 173, page 40, where are given also references to publications that contain data for previous years.

Discharge measurements of Purgatory River at Trinidad, Colo., in 1906–7.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
November 1	L. D. Bull	32	24	4.30	47
November 9	do	32	21	4.25	34
November 16	do	29	22	4.30	36
November 29	do	31	19	4.20	29
December 9	do	32	18	4.20	30
December 23 [a]	do	30	19	4.28	10
1907.					
January 5	L. D. Bull	30	16	4.15	19
January 10	do	27	13	4.02	14
January 19	do	28	14	4.10	18
January 30	do	29	17	4.20	24
February 6	do	29	14	4.05	17

[a] Measurement is about 30 per cent of the open-channel rating, owing to needle ice in the river.

Daily gage height, in feet, of Purgatory River at Trinidad, Colo., for 1906.

Day.	Nov.	Dec.	Day.	Nov.	Dec.	Day.	Nov.	Dec.
1	4.3	4.2	12	4.25	4.2	23	4.35	4.35
2	4.4	4.2	13	4.25	4.15	24	4.25	4.5
3	4.35	4.4	14	4.25	4.1	25	4.2	4.1
4	4.3	4.3	15	4.25	4.05	26	4.45	4.15
5	4.3	4.3	16	4.2	4.0	27	4.35	4.05
6	4.3	4.15	17	4.3	4.05	28	4.3	4.05
7	4.25	4.15	18	4.2	4.15	29	4.2	4.05
8	4.25	4.1	19	4.4	4.2	30	4.2	4.05
9	4.25	4.2	20	4.4	4.2	31		4.3
10	4.25	4.2	21	4.4	4.2			
11	4.25	4.2	22	4.55	4.3			

NOTE.—Needle ice in river during part of December.

Rating table for Purgatory River at Trinidad, Colo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.00	13	4.20	27	4.40	60	4.60	120
4.10	18	4.30	41	4.50	88		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 10 discharge measurements made during 1906–7 and is well defined below gage height 4.3 feet.

Monthly discharge of Purgatory River at Trinidad, Colo., for 1906.

[Drainage area, 742 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
November	104	27	43.0	2,560	0.058	0.06
December	88	13	28.3	1,740	.038	.04
The period				4,300		

NOTE.—Values are rated as follows: November, good; December, approximate, owing to uncertainty concerning ice conditions.

PURGATORY RIVER NEAR ALFALFA, COLO.

This station was established March 23, 1905, one-eighth of a mile below the canyon entrance, 4 miles east of Alfalfa post-office, and about 25 miles east of Trinidad, in T. 33 S., R. 60 W. On November 1, 1906, it was transferred to Trinidad, Colo., for the winter months. The conditions at the station and the bench marks are described in Water-Supply Paper No. 173, page 41.

Discharge measurements of Purgatory River near Alfalfa, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 27	L. D. Bull	70	64	4.22	83
January 31	do	26	22	3.58	44
February 2	do	22	7	2.80	7
February 11	do	20	9	2.75	9
February 14	do	40	22	3.10	32
February 18	do	16	8	2.70	11
February 22	do	40	25	3.10	45
February 26	do	16	9	2.70	10
March 8	do	14	6.4	2.45	6.31
March 12	do	16	7.6	2.55	8.81
March 19	do	15	5.7	2.40	4.34
March 26	do	12	4.5	2.35	3.82
April 2	do	12	3.9	2.25	1.36
April 10	do	12	3.3	2.20	.81
April 16	do	12	3.6	2.20	1.59
April 22	do	38	40	3.50	95
April 28	do	42	19	2.75	24
May 6	do	30	12	2.60	11
June 4	do	20	24	2.80	37
October 9	R. I. Meeker	24	18	2.64	25
October 9	L. D. Bull	24	17	2.62	25
October 18	do	23	14	2.45	14

Daily gage height, in feet, of Purgatory River near Alfalfa, Colo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	3.0	3.0	2.55	2.3	2.6	2.2	2.6	3.5	2.3	2.7
2	3.0	2.8	2.5	2.25	2.6	4.56	10.05	3.7	2.3	2.7
3	3.0	2.8	2.45	2.25	2.6	3.55	3.2	3.55	4.65	2.7
4	2.95	2.8	2.45	2.2	2.5	2.85	2.8	3.3	3.8	2.7
5	2.95	2.8	2.45	2.2	2.4	2.62	2.9	3.0	3.6	2.7
6	2.95	2.8	2.45	2.2	2.5	2.35	3.0	5.95	2.9	2.7
7	2.95	2.8	2.45	2.2	2.5	2.3	2.7	4.0	2.7	2.7
8	2.9	2.8	2.45	2.2	2.5	2.2	2.7	3.55	2.7	2.9
9	2.9	2.8	2.45	2.2	2.45	2.15	4.8	3.2	2.6	2.6
10	2.9	2.8	2.45	2.2	2.4	2.1	3.76	5.0	2.6	2.45

Daily gage height, in feet, of Purgatory River near Alfalfa, Colo., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
11	2.9	2.8	2.6	2.2	2.4	2.1	3.28	4.1	2.45	2.4
12	2.9	2.8	2.55	2.2	2.35	4.48	2.85	3.8	2.4	2.4
13	2.9	3.1	2.55	2.4	2.35	3.5	2.75	3.6	2.35	2.35
14	3.35	3.15	2.9	2.3	2.56	3.5	2.7	3.3	2.3	2.5
15	3.35	3.05	2.8	2.25	2.4	3.6	6.84	3.0	2.3	2.5
16	3.35	2.9	2.7	2.2	2.3	3.6	8.3	2.95	2.3	2.45
17	3.35	2.9	2.6	2.2	2.3	3.55	5.32	2.8	2.3	2.4
18	3.3	2.7	2.5	2.2	2.3	3.6	6.6	2.8	3.0	2.35
19	3.3	2.7	2.4	2.5	2.51	3.25	4.95	3.65	2.75	2.3
20	3.3	2.7	2.5	2.8	2.3	2.92	4.7	3.4	2.55	2.3
21	3.3	3.0	2.5	3.3	3.3	2.8	4.3	3.3	2.4	2.4
22	3.35	3.1	2.5	3.55	3.0	2.7	7.2	2.8	2.35	2.65
23	3.4	3.0	2.5	3.32	3.0	6.1	7.1	2.7	2.3	2.65
24	3.6	2.95	2.5	3.18	2.8	3.5	8.36	3.45	3.2	2.75
25	3.8	2.85	2.4	2.82	2.5	3.1	6.3	2.8	2.6	2.95
26	3.9	2.7	2.35	2.7	2.4	2.85	4.3	2.8	3.7	2.8
27	4.2	2.6	2.45	2.8	2.3	2.75	4.1	2.5	4.35	2.6
28	4.0	2.6	2.4	2.75	2.3	2.65	4.0	2.4	3.15	2.6
29	3.95	.....	2.35	2.85	2.4	2.6	3.7	2.4	2.85	2.55
30	3.6	.....	2.3	2.7	2.3	2.6	3.6	2.3	2.8	2.45
31	3.35	.....	2.3	.....	2.2	.....	3.55	2.3	.....	2.4

NOTE.—This station transferred to Trinidad on November 1 for the winter months.

Daily discharge, in second-feet, of Purgatory River near Alfalfa, Colo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	Day.	Jan.	Feb.	Mar.	Apr.	May.
1	13	13	6	2	13	17	30	20	10	1.6	4
2	13	7	5	1.4	13	18	27	11	7	1.6	5
3	13	7	3	1.4	12	19	27	11	4	11	13
4	12	7	4	1	8	20	27	13	7	27	5
5	12	9	4	1	5	21	27	34	7	73	70
6	12	9	5	1	7	22	30	45	7	101	44
7	12	9	6	1	7	23	32	37	7	75	44
8	10	9	6	1	7	24	44	30	7	60	29
9	10	9	6	1	6	25	56	20	4	29	16
10	10	9	6	1	6	26	62	10	3	21	11
11	10	9	10	1	6	27	81	7	6	27	7
12	10	11	9	1	5	28	68	7	4	24	7
13	10	32	9	4	5	29	65	.....	3	29	11
14	30	35	23	4	12	30	44	.....	2	20	7
15	30	28	18	3	6	31	30	.....	2	.....	4
16	30	20	14	1.6	3						

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Rating table for Purgatory River near Alfalfa, Colo., from June 1 to October 31, 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.10	3	3.30	76	4.50	208	6.40	695
2.20	5	3.40	85	4.60	222	6.60	778
2.30	8	3.50	95	4.70	237	6.80	865
2.40	12	3.60	105	4.80	253	7.00	955
2.50	17	3.70	115	4.90	271	7.20	1,045
2.60	23	3.80	126	5.00	290	7.40	1,145
2.70	30	3.90	137	5.20	331	7.60	1,250
2.80	37	4.00	148	5.40	377	7.80	1,360
2.90	44	4.10	159	5.60	427	8.00	1,480
3.00	52	4.20	171	5.80	483	9.00	2,140
3.10	60	4.30	183	6.00	545	10.00	2,900
3.20	68	4.40	195	6.20	618	11.00	3,780

NOTE.—The above table is based on 4 discharge measurements made during June to October, 1906, and high-water measurements of 1905. It is not well defined.

Monthly discharge of Purgatory River near Alfalfa, Colo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	81	10	28.6	1,760
February	45	7	16.7	928
March	23	2	6.90	424
April	101	1	17.6	1,050
May	70	3	12.8	787
June	581	3	76.5	4,550
July	2,940	23	431	26,500
August	529	8	89.4	5,500
September	230	8	45.6	2,710
October	48	8	22.1	1,360
The period				45,600

NOTE.—Values are rated as approximate, owing to shifting conditions of flow.

CIMARRON RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Cimarron River rises in the Raton Mountain Range in Colfax County, N. Mex., at an elevation of nearly 7,000 feet, and flows eastward across Beaver County, in Oklahoma, then across the southwest corner of Kansas, entering Oklahoma again in Woodward County and following a southeasterly course to its junction with Arkansas River at the Indian Territory line. The basin lies between those of Arkansas and North Canadian rivers, and is within the arid belt. From west to east it is 100 miles from the source to the gaging station at Garrett, Okla., and 450 miles to its mouth; its extreme width is not more than 50 miles; its area is 5,200 square miles.

CIMARRON RIVER NEAR GARRETT, OKLA.

This station was established May 8, 1905. It is located at Strong's ranch, about 3 miles west of Garrett, Okla., 20 miles east of Kenton, and 50 miles by stage from Clayton, N. Mex., the nearest railroad station. The station is below the mouth of North Carriso and South Carriso creeks and 1 mile below the site of the proposed dam for a storage reservoir. The conditions and the bench marks are described in Water-Supply Paper No. 173, page 46.

Discharge measurements of Cimarron River near Garrett, Okla., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq.-ft.*	*Feet.*	*Sec.-ft.*
April 21	E. Patterson	14	10	0.83	15
April 21	do	13	9	.78	13
April 22	do	12	8	.69	10
April 23	do	12	7	.64	8
May 21	do	5	1.8	.37	1.8
June 22	do	11	4.5	.41	2.6
June 24	do	104	573	8.20	1,960
June 25	do	74	302	5.05	728
June 25	do	76	328	5.50	870
June 25	do	99	401	6.30	1,110
June 25	do	77	347	6.00	974
June 25	do	74	281	4.20	542
June 26	do	74	268	4.10	509
June 26	do	75	295	4.65	622
June 26	do	78	325	5.07	752
June 26	do	75	292	4.40	580
June 27	do	65	156	1.87	109
June 27	do	65	160	1.75	99
August 18	J. M. Giles	12	7	.60	7
August 19	do	12	7	.62	8
October 25	Wm. A. Lamb	22	23	1.02	32

Daily gage height, in feet, of Cimarron River near Garrett, Okla., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.85	0.85	0.5	0.4	0.55	0.4	0.9	0.85	0.95	1.4	1.0	1.0
2	.85	.85	.5	.4	.55	.4	.9	1.65	.85	1.5	1.0	1.0
3	.8	.85	.5	.4	.5	5.6	2.72	1.2	.9	1.0	1.0	1.0
4	.8	.75	.5	.45	.5	3.7	1.4	1.1	.9	1.0	1.0	1.0
5	.8	.65	.5	.4	.5	1.1	1.1	1.0	1.0	.95	1.0	1.0
6	.8	.65	.6	.4	.45	1.0	1.0	.9	.9	.9	1.0	1.0
7	.8	.6	.45	.4	.45	.8	.9	.85	.85	.9	1.0	.95
8	.8	.6	.45	.4	.45	.75	.9	.75	.8	.9	1.0	.95
9	.8	.6	.4	.4	.4	.7	2.65	.85	.7	.9	1.0	.95
10	.8	.65	.4	.4	.4	.65	2.68	1.2	.7	1.0	1.0	.95
11	.85	.65	.45	.4	.4	.6	1.78	.9	.7	.95	1.0	.95
12	.9	.7	.45	.35	.4	.6	1.0	.75	.7	.95	.95	.95
13	.95	.75	.45	.35	.4	.6	1.0	.7	.65	.95	.95	.95
14	1.0	.75	.6	.35	.4	.6	1.0	.7	7.58	1.0	.95	.95
15	1.0	.75	.55	.35	.4	.55	3.52	.65	8.2	1.0	.95	.95
16	.95	.75	.6	.35	.4	.55	4.0	1.6	3.5	1.0	.95	.95
17	.95	.75	.65	.35	.35	.55	1.7	.9	2.5	1.0	.95	.9
18	.95	.75	.65	.35	.35	.55	1.6	.65	1.5	1.0	.9	.9
19	.95	.75	.65	3.35	.35	.5	1.7	.6	1.4	1.0	.9	.9
20	.95	.7	.6	.9	.35	.45	1.0	.6	1.15	1.0	.9	.9
21	.9	.7	.6	.85	.35	.45	1.0	.85	1.0	1.0	.9	.9
22	.85	.7	.6	.7	.35	.4	.95	1.1	2.0	1.0	.9	.9
23	.75	.7	.6	.65	4.5	3.5	.9	2.1	1.4	1.0	.9	.9
24	.9	.7	.4	.6	1.1	8.5	.85	1.85	1.0	1.0	1.0	.9
25	.9	.7	.4	.55	.85	5.95	4.75	1.0	1.0	1.0	1.5	.9
26	.85	.7	.4	.55	.6	4.25	3.34	7.09	2.0	1.0	1.4	.9
27	.8	.7	.5	.5	.55	1.1	1.6	1.7	[a] 7.1	1.0	1.2	.9
28	.85	.6	.4	.5	.5	1.35	1.4	1.55	2.0	1.0	1.15	.9
29	.85	.....	.4	.55	.45	1.1	1.5	1.5	1.7	1.0	1.1	.9
30	.85	.....	.4	.55	.45	1.0	1.0	2.0	1.5	1.0	1.1	.9
31	.85	.....	.4	.....	.4	.....	.9	1.3	.....	1.0	.....	.9

[a] Maximum gage height, 12.0 feet.

Rating table for Cimarron River near Garrett, Okla., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.30	0.5	1.40	57	2.50	195	4.20	524
.40	2.5	1.50	68	2.60	211	4.40	571
.50	4.8	1.60	79	2.70	228	4.60	619
.60	7.5	1.70	90	2.80	245	4.80	669
.70	10.5	1.80	102	2.90	262	5.00	720
.80	14	1.90	114	3.00	280	6.00	1,020
.90	19	2.00	126	3.20	316	7.00	1,410
1.00	24	2.10	139	3.40	353	8.00	1,910
1.10	30	2.20	152	3.60	392	9.00	2,510
1.20	38	2.30	166	3.80	434	10.00	3,150
1.30	47	2.40	180	4.00	478		

NOTE.—The above table is based on discharge measurements made during 1906 and is well defined. It has also been applied to 1905 gage heights above 6.0 feet and the monthly discharges as recomputed are given below.

Monthly discharge of Cimarron River near Garrett, Okla., for 1905–6.

Month.	Discharge in second-feet			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
May 7–31	3,380	25	307	15,200
June	2,700	14	144	8,570
July	159	5	24.5	1,510
August	1,220	6	142	8,730
September	810	5	88.1	5,240
October	14	7	10.4	640
November	68	14	19.7	1,170
December	19	8	15.4	947
The period				42,000
1906.				
January	24	12	17.4	1,070
February	16	7.5	10.9	605
March	9	2.5	5.0	307
April	344	1.5	16.0	952
May	595	1.5	23.7	1,460
June	2,210	2.5	191	11,400
July	656	16	113	6,950
August	1,460	7.5	85.7	5,270
September	2,030	9	226	13,400
October	68	19	25.6	1,570
November	68	19	26.4	1,570
December	24	19	20.9	1,290
The year	2,210	1.5	63.5	45,800

NOTE.—The above values for 1905 supersede those given in Water-Supply Paper No. 173. They are more accurate owing to the availability of new data since the first publication in the 1905 report. Values for 1905 and 1906 are rated as excellent.

MISCELLANEOUS MEASUREMENTS IN CIMARRON RIVER DRAINAGE BASIN.

Miscellaneous measurements made on Cimarron River by J. M. Giles in 1906.

Date.	Stream.	Locality.	Width.	Area of section.	Gage height.	Discharge.
			Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 20	Cimarron River	Springer, N. Mex		82	2.00	263
August 14	do	do	46	23	1.12	27
August 15	do	do	46	21	1.10	22

CANADIAN RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Canadian River rises in the mountains of Colfax County, N. Mex., flows southward across Mora and San Miguel counties, then turns east and flows across northern Texas, Oklahoma, and Indian Territory, uniting with Arkansas River about 80 miles above Fort Smith, Ark.

The drainage area is wooded in the upper portion and in Indian Territory, but consists of dry plains in Texas and Oklahoma. There are few tributaries, Ute Creek and Mora and Sapello rivers in New Mexico being the principal ones. The run-off is very uncertain, varying from extreme floods to practically nothing in a dry season.

CANADIAN RIVER AT CALVIN, IND. T.

This station was established in 1904 by the United States Weather Bureau. It is located at the railroad bridge about one-fourth mile west of Calvin, Ind. T. The conditions and the bench marks are described in Water-Supply Paper No. 173, page 58, where are given also references to publications that contain data for previous years.

Discharge measurements of Canadian River at Calvin, Ind. T., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 9	E. R. Kerby	240	281	3.20	678
January 30	J. M. Giles	207	286	3.02	309
February 27	E. R. Kerby	370	444	3.40	636
March 13	do	95	112	2.80	200
April 27	Wm. A. Lamb	160	153	2.56	233
May 29	J. M. Giles	540	614	3.68	1,640
June 6	Wm. A. Lamb	560	1,090	4.80	3,810
June 14	do	267	245	3.13	357
July 9	do	115	93	2.90	94
July 14	do	565	1,260	4.35	3,750
July 15	do	563	1,340	4.38	4,010
July 26	do	700	2,120	5.70	10,200
July 27	do	658	1,840	5.28	6,560
August 14	do	715	2,500	5.80	14,400
August 19	do	420	1,230	3.55	4,240
August 26	J. M. Giles	655	1,620	3.90	6,009
August 26	Wm. A. Lamb	675	1,810	3.95	6,240
September 21	do	685	1,840	3.58	6,110
October 18	do	341	480	2.52	1,110
November 8	do	217	245	2.30	300
December 23	do	230	306	2.90	724
August 26[a]	Giles and Lamb	825	14,600	21.00	128,000

[a] Computed from a slope measurement made using Kutter's formula.

Daily gage height, in feet, of Canadian River at Calvin, Ind. T., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.0	2.9	3.1	3.0	4.6	5.0	3.4	4.4	3.0	2.0	2.6	3.9
2	3.1	2.8	3.5	2.8	3.9	3.6	3.4	4.3	3.0	2.3	2.5	3.5
3	3.6	2.8	3.4	3.0	4.5	3.7	3.2	4.0	2.9	2.2	2.4	3.5
4	3.7	2.7	3.2	3.1	4.1	6.7	3.1	3.9	2.8	2.3	2.4	4.1
5	3.5	3.2	3.0	5.5	3.7	5.3	3.0	4.3	2.6	2.1	2.4	4.4
6	3.3	2.8	3.0	5.0	3.2	4.8	3.0	3.9	3.7	2.0	2.3	4.4
7	3.3	2.8	3.1	4.7	3.1	4.6	2.9	14.0	2.8	2.0	2.2	3.6
8	3.2	2.7	2.9	4.7	3.1	4.4	2.9	9.8	2.9	2.0	2.2	3.1
9	3.1	2.8	2.9	4.4	3.2	4.2	2.9	7.4	2.9	2.0	2.2	3.5
10	3.2	2.7	2.9	4.0	3.0	3.8	2.9	5.4	2.8	2.0	2.2	3.5
11	3.1	2.7	2.8	3.6	2.9	3.7	2.9	4.6	2.8	1.9	2.2	3.5
12	3.0	2.7	2.8	3.5	2.8	3.3	4.1	4.5	11.1	1.8	2.1	3.3
13	3.0	3.0	2.8	4.0	2.7	3.1	3.6	5.6	7.4	2.1	2.1	3.1
14	3.2	3.0	2.7	3.6	2.7	3.1	4.5	5.9	5.0	2.1	2.2	3.0
15	3.2	2.9	2.7	3.3	2.6	3.3	4.5	4.5	4.5	2.4	2.2	3.1
16	3.1	2.9	2.6	3.1	3.0	3.8	4.6	4.1	4.1	2.8	2.2	3.0
17	3.1	2.9	2.4	3.0	3.5	3.4	3.8	3.7	4.4	2.7	2.1	3.0
18	3.7	2.9	2.8	2.9	3.0	3.8	3.8	3.4	4.2	2.5	2.1	3.0
19	3.5	3.4	3.0	3.0	2.9	3.6	4.5	3.6	4.0	3.4	2.1	2.9
20	3.5	3.7	2.8	3.1	2.8	3.5	4.6	3.4	3.9	3.1	2.1	3.3
21	3.2	3.2	2.8	3.1	2.8	3.4	4.5	3.1	3.6	2.8	2.1	3.1
22	3.2	3.0	2.8	3.3	2.8	3.3	4.1	3.0	3.3	2.8	2.2	3.0
23	2.9	3.0	2.8	3.1	3.2	3.2	3.8	2.9	3.0	2.5	2.2	2.9
24	2.8	2.9	3.0	2.8	3.9	3.1	5.4	3.2	2.9	2.3	2.2	2.9
25	3.0	3.6	3.0	2.5	3.3	3.1	5.0	3.2	2.9	2.2	2.2	2.8
26	3.2	3.4	3.3	2.5	3.1	3.1	5.5	3.9	2.7	2.2	2.2	2.8
27	3.0	3.4	3.5	2.5	4.0	3.0	5.3	3.8	2.9	2.1	2.3	3.1
28	3.0	3.2	3.6	2.3	3.3	3.0	4.6	3.4	2.6	2.2	2.5	3.0
29	3.0	.....	3.6	2.3	3.8	3.0	4.5	3.0	2.3	2.4	2.6	3.0
30	3.0	.....	3.7	4.8	3.7	3.8	5.9	2.9	2.3	2.6	2.7	3.0
31	2.9	.....	3.6	.....	3.2	.....	5.1	3.1	.....	2.4	.....	2.9

Daily discharge, in second-feet, of Canadian River at Calvin, Ind. T., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	275	175	510	390	3,500	4,950	1,000	2,975	2,250	100	460	2,450
2	460	100	1,200	200	1,940	1,360	1,000	2,750	2,250	400	400	1,600
3	1,590	100	1,000	390	3,210	1,550	670	2,140	1,980	250	340	1,600
4	1,830	75	670	510	2,330	21,700	510	1,940	1,710	400	340	3,000
5	1,340	450	390	8,200	1,550	6,700	390	2,750	1,280	200	340	3,950
6	880	100	390	4,950	675	4,140	390	1,940	4,950	100	300	3,950
7	880	100	500	3,800	360	3,500	275	65,700	1,700	100	240	1,800
8	690	75	280	3,800	360	2,980	275	32,600	1,980	100	240	975
9	475	100	280	2,960	660	2,550	275	22,800	1,980	100	240	1,600
10	690	75	280	2,140	390	1,740	275	12,500	1,700	100	240	1,600
11	475	75	200	1,360	275	1,550	275	8,820	1,700	50	240	1,600
12	275	75	200	1,200	200	830	2,330	8,410	47,800	25	200	1,270
13	275	300	200	2,140	130	500	1,350	13,500	22,800	175	200	975
14	690	300	130	1,360	130	500	3,210	14,900	11,500	175	240	850
15	690	200	130	825	90	830	3,210	8,400	9,400	350	240	975
16	475	200	100	510	390	1,740	3,500	6,800	7,870	625	240	975
17	475	200	30	390	1,200	1,000	1,740	5,000	9,000	540	200	850
18	1,830	200	200	275	390	1,740	1,740	3,600	8,250	400	200	850
19	1,340	640	390	390	275	1,360	3,210	4,500	7,500	1,240	200	730
20	1,340	870	200	510	200	1,200	3,500	3,600	7,120	900	200	1,280
21	680	450	200	510	200	1,000	3,210	2,570	6,100	625	200	975
22	680	300	200	825	200	830	2,340	2,250	5,100	625	240	850
23	175	300	200	510	660	660	1,740	1,990	3,500	400	240	740
24	100	200	390	190	1,940	510	7,400	2,900	3,000	340	240	740
25	300	860	390	50	830	510	4,950	2,900	2,900	250	240	630
26	450	630	820	50	360	510	8,250	6,000	1,900	250	240	630
27	300	630	1,200	50	2,140	390	6,650	5,700	2,800	200	300	975
28	300	450	1,410	25	830	390	3,500	3,600	1,460	240	400	850
29	300	.....	1,410	25	1,740	390	3,210	2,250	500	340	470	850
30	300	.....	1,650	4,150	1,550	1,740	12,500	1,990	500	470	530	850
31	175	.....	1,410	.....	675	.....	5,450	2,570	.....	340	.....	740

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Canadian River at Calvin, Ind. T., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	1,830	100	669	41,100
February	870	75	294	16,300
March	1,650	30	534	32,800
April	8,200	25	1,420	84,500
May	3,500	90	948	58,300
June	21,700	390	2,310	137,000
July	12,500	275	2,850	175,000
August	65,700	1,940	8,400	516,000
September	47,800	500	6,080	362,000
October	1,240	25	336	20,700
November	530	200	280	16,700
December	3,950	630	1,350	83,000
The year	65,700	25	2,130	1,540,000

MORA RIVER AND CANAL AT LA CUEVA, N. MEX.

This station was established August 25, 1903, by M. C. Hinderlider. It is located at the wagon bridge at the village of La Cueva, N. Mex., in the Mora land grant, 26 miles directly north of Las Vegas. The bridge to which the gage was attached was carried away during the flood of September 29, 1904, but the station was reestablished April 29, 1905, at the old section, the bridge having been replaced. The conditions at the river station and the bench marks are described in Water-Supply Paper No. 173, page 60, where are given also references to publications that contain data for previous years.

The conditions at the canal station and the bench mark are described in Water-Supply Paper No. 131, page 163.

Discharge measurements of Mora River at La Cueva, N. Mex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 17	E. Patterson	24	30	1.27	61
April 27	J. M. Giles	23	37	1.60	110
May 25	E. Patterson	22	37	1.55	96
July 19	J. M. Giles	22	24	1.30	59
September 25	Wm. A. Lamb	16.5	13	.70	11

Daily gage height, in feet, of Mora River at La Cueva, N. Mex., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.6	1.5	0.6	1.3	0.8	1.0	1.15	0.95
2	.....	1.6	1.6	.7	1.2	.8	1.0	1.1	1.0
3	.....	1.6	1.8	1.15	1.3	1.2	.95	1.1	1.0
4	.....	1.6	1.7	1.3	1.2	1.1	.8	1.1	2.3
5	.....	1.65	1.6	1.3	1.35	.9	1.2	1.05	1.4
6	.....	1.8	1.45	1.3	1.2	.9	1.2	.....	1.15
7	.....	1.7	1.6	1.2	1.15	.9	1.15	1.0	1.2
8	.....	1.6	1.5	1.7	1.2	.85	1.05	1.0	1.3
9	.....	1.6	1.45	1.7	1.3	.8	1.0	1.0	1.2
10	.....	1.7	1.6	1.5	1.1	.85	1.0	1.0	1.2

Daily gage height, in feet, of Mora River at La Cueva, N. Mex., for 1906—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	.....	1.8	1.5	1.4	1.0	0.85	1.0	1.0	1.1
12	.....	1.75	1.5	1.35	1.0	.8	.95	1.0	1.1
13	1.2	1.8	1.8	1.3	.9	.8	1.0	.95	1.1
14	1.15	1.65	1.7	1.4	.7	.7	1.0	.95	.8
15	1.1	1.65	1.5	1.3	.65	.8	1.0	.95	.8
16	1.4	1.6	1.4	[a] 1.3	.55	.75	1.0	.9	.9
17	1.3	1.6	1.6	1.4	.55	.7	.95	.9	1.0
18	1.3	1.6	1.4	1.4	.55	.75	.95	.85	1.0
19	1.5	1.8	1.2	1.3	.6	.75	.9	.8	.9
20	1.45	1.75	1.0	1.55	1.0	.7	.9	.9	1.0
21	1.5	1.7	1.1	1.2	1.0	.7	.95	1.05	.85
22	1.6	1.65	1.1	1.25	.9	.7	.95	.9	.9
23	1.7	1.65	1.0	1.25	.9	.7	.95	.9	.8
24	1.8	1.7	1.25	1.2	.9	.7	.85	.9	.8
25	1.75	1.6	.9	1.15	.8	.6	1.2	.85	.8
26	1.75	1.5	.7	1.5	.9	.8	1.15	.85	.8
27	1.65	1.5	.7	1.2	.8	1.4	1.2	.8	.8
28	1.6	1.6	.6	1.4	.8	1.2	1.15	.85	.85
29	1.6	1.7	.6	1.4	.8	1.1	1.15	.9	.7
30	1.6	1.6	.55	1.45	.9	1.05	1.1	.9	.8
31	.....	1.6	.....	1.3	.9	.....	1.15	.....	.9

[a] Maximum gage height, 4.4 feet.

Rating table for Mora River at La Cueva, N. Mex., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.55	4	0.90	24	1.30	61	1.70	125
.60	6	1.00	32	1.40	74	1.80	150
.70	11	1.10	40	1.50	89	2.30	300
.80	17	1.20	50	1.60	106		

NOTE.—The above table is based on 5 discharge measurements made during 1906 and is well defined.

Monthly discharge of Mora River at La Cueva, N. Mex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 13–30	150	40	93.4	3,330
May	150	89	117	7,190
June	150	4	71.6	4,260
July	125	6	65.4	4,020
August	68	4	30.2	1,860
September	74	6	22.2	1,320
October	50	17	34.5	2,120
November	45	17	28.4	1,690
December	300	11	39.4	2,420
The period	.....	.....	.....	28,200

NOTE.—Values are rated as follows: April to July, excellent; August to December, good.

Discharge measurements of Mora canal at La Cueva, N. Mex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 27	J. M. Giles	8.5	9.2	1.20	14
May 25	E. Patterson	8	9.2	1.15	14
September 26	Wm. A. Lamb	6.5	6.4	.93	5.0

Daily gage height, in feet, of Mora canal at La Cueva, N. Mex., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		1.2	1.4	1.0	0.75	1.2			
2		1.1	1.3	1.0	1.2	1.05			
3		1.1	1.1	1.1	.95	1.1	0.2		
4		1.15	1.2	1.25	.95	.7	.4		
5		1.2	1.2	1.25	1.1	.6			
6		.95	1.35	1.2	1.0	.55	1.2		
7		1.2	1.3	1.05	1.1	.7			
8		1.3	1.2		1.15	.5	.8		
9		1.15	1.3		1.1	.6	.9		
10		1.2	1.25		.9	.4	.95		
11		1.2	1.2		.8	.2	1.0		
12		1.3	1.35	.85	.8	.6	.9		
13	1.1	1.3	1.25	.7	.75		.6		
14	1.1	1.1	1.2	.7	.7	1.0	.8		
15	1.2	1.15	1.35	1.05	.65	1.0	.8		
16		1.1	1.2	1.0	1.0	1.1	.4		
17	1.2	1.2	1.4		1.0	1.2			
18	1.2	1.1	1.2		1.0	1.1			
19		1.3	1.2		1.2	1.1			
20		1.4	1.2		1.2	1.15			
21		1.3	1.25		1.2	1.05			1.0
22		1.2	1.3		1.0	.95			.6
23		1.0	1.3		.8	.85			.9
24		1.3	1.3		.8	.9			.8
25		1.2	1.3		.8	.9			1.0
26		1.2	1.4		.7	.9			1.0
27	.85	1.35	1.3		1.2	.7			.8
28	1.05	1.05	1.2		1.2	.95			.9
29	1.0	1.1	1.0		1.2				.8
30	1.3	1.4	.9	.8	1.0	.4			
31		1.4		.8	.9				

NOTE.—Water was turned out on the days when the gage was not read.

Rating table for Mora canal at La Cueva, N. Mex., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.20	0.4	0.60	2.0	1.00	6.4	1.40	27
.30	.6	.70	2.6	1.10	9.8		
.40	1.0	.80	3.5	1.20	15		
.50	1.4	.90	4.6	1.30	21		

NOTE.—The above table is based on 3 discharge measurements made during 1906 and is not well defined.

Monthly discharge of Mora canal at La Cueva, N. Mex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April (9 days)	21	4.0	11.6	207
May	27	5.5	15.5	953
June	27	4.6	18.2	1,080
July (14 days)	18	2.6	8.0	222
August	15	2.3	7.6	467
September (28 days)	15	.4	5.5	305
October (12 days)	15	.4	4.2	100
December (9 days)	6.4	2.0	4.5	80
The period				3,420

NOTE.—Values are rated as approximate.

SAPELLO RIVER AT LOS ALAMOS, N. MEX.

This station was established August 22, 1903, for the purpose of determining the amount of water available for diversion into the San Guijuela reservoir for the Las Vegas project. It is located at a ford crossing Sapello River at a point about one-fourth mile due north from Los Alamos, N. Mex., which is about 13 miles north of Las Vegas. The conditions at the station and the bench marks are described in Water-Supply Paper No. 173, page 63, where are given also references to publications that contain data for previous years.

Discharge measurements of Sapello River at Los Alamos, N. Mex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 15	J. M. Giles	12	9	0.83	17
April 16	E. Patterson	32	28	1.35	60
April 17	do	54	32	1.40	60
April 27	J. M. Giles	54	33	1.40	71
May 25	E. Patterson	28	22	.60	41
July 19	J. M. Giles	27	16	.40	21
July 20	do	28	19	.55	30
August 16	do	20	8	−.05	5
September 25	Wm. A. Lamb	8	2.4	−.20	2.1

Daily gage height, in feet, of Sapello River at Los Alamos, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.50	0.90	0.70	1.15	1.35	0.55	.....	0.25	−0.10	−0.15	0.28	0.32
2	.60	.90	.70	1.15	1.40	1.15	0.10	.25	−.10	−.15	.32	.92
3	.65	.80	.70	1.20	1.50	.90	.15	.25	+.40	−.12	.32	1.00
4	.70	.80	.70	1.15	1.45	.85	.10	.30	.40	−.08	.28	3.70
5	.85	.80	.70	1.15	1.55	.75	.15	.30	.25	−.05	.22	2.65
6	.95	.80	.70	1.15	1.40	.65	.25	.30	.20	−.10	.20	2.30
7	1.15	.80	.70	2.05	1.55	.60	.15	.30	.08	−.12	.28	2.35
8	1.35	.80	.70	1.20	1.40	.65	.45	.20	−.08	−.12	.28	1.45
9	1.35	.80	.70	1.15	1.40	.55	.30	.20	−.08	+.20	.20	1.05
10	1.35	.80	.70	1.15	1.80	.55	.15	.15	−.10	.12	.22	.95
11	1.40	.80	.70	1.15	1.65	.55	.10	.10	−.10	.22	.22	1.00
12	1.55	.80	.70	1.15	1.35	.55	.10	.10	−.10	.20	.20	.85
13	1.45	.80	.70	1.15	1.15	1.05	1.00	.00	−.10	.20	.22	.55
14	1.35	.80	.80	1.15	1.05	.90	.50	.00	−.20	.18	.18	.62
15	1.00	.80	.80	1.15	.95	.40	.40	−.10	−.18	.25	.20	.60
16	1.00	.85	.80	1.25	.90	.35	.70	−.10	−.20	.25	.22	.52
17	1.15	.80	.80	1.35	.80	.25	.40	−.10	−.18	.15	.22	.68
18	1.15	.80	.80	1.30	.90	.15	.30	+.10	−.18	.20	.25	.72
19	.95	.80	.80	1.50	.85	.10	.40	−.05	−.22	.20	.20	.50
20	.95	.80	.80	1.35	1.05	.10	.45	−.10	−.20	.18	.20	.52
21	.95	.80	.80	1.30	.85	0	.30	−.10	−.20	.10	.20	.55
22	.90	.80	.80	1.35	.75	0	.30	−.18	−.12	.10	.20	.62
23	.90	.80	.80	1.35	.70	−.10	.30	.28	−.15	.15	.20	.48
24	.90	.80	.80	1.30	.75	−.10	.25	.15	−.20	.12	.20	.50
25	.90	.80	.80	1.30	.65	−.10	−.10	.10	−.20	.20	.20	.50
26	.95	.80	.90	1.35	.60	−.10	.25	.00	+.15	.18	.22	.48
27	.90	.80	.90	1.35	.60	−.10	.20	−.08	.75	.18	.26	.50
28	.90	.80	1.10	1.40	.55	−.10	.20	−.10	.35	.20	.20	.48
29	.90	.....	1.15	1.35	.45	−.10	1.10	−.08	.20	.25	.20	.48
30	.90	.....	1.15	1.35	.55	−.10	.45	−.10	.02	.25	.20	.50
31	.90	.....	1.15	.....	.55	.....	.30	−.10	.....	.25	.....	.45

UTE CREEK NEAR LOGAN, N. MEX.

This station was established August 12, 1904, and was discontinued June 30, 1906. It was located about 7 miles northwest of Logan, N. Mex., and about 4 miles above the mouth of Ute Creek, near the old Martinez house. The conditions at the station and the bench marks are described in Water-Supply Paper No. 173, page 64, where are given also references to publications that contain data for previous years.

Discharge measurements of Ute Creek near Logan, N. Mex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 12	J. M. Giles	1	0.2	0.75	0.1
April 13	E. Patterson	1.2	.08	.71	.02

Daily gage height, in feet, of Ute Creek near Logan, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.9	0.9	0.8	0.4	0.8	0.8	17	1.2	0.9	0.5	0.6	0.8	0.6
2	.9	.9	.5	.4	.7	.6	18	1.1	.9	.5	.6	.6	.6
3	.9	.9	.5	.4	.6	4.4	19	1.1	.9	.5	1.4	.6	.6
4	1.0	.9	.5	.4	.6	2.1	20	1.0	.9	.5	1.2	.6	.6
5	1.0	.9	.5	.8	.6	1.9	21	1.0	.8	.5	1.2	.6	.6
6	1.0	.9	.5	.8	.6	1.0	22	1.0	.8	.5	1.2	1.45	.6
7	1.0	.9	.5	.8	.6	1.0	23	.9	.8	.5	1.0	2.1	.6
8	1.0	.9	.5	.8	.6	.9	24	.9	.8	.5	1.0	1.9	.6
9	1.0	.9	.5	.8	.6	.8	25	.9	.8	.5	.8	1.0	.6
10	1.0	.9	.5	.8	.6	.8	26	.9	.8	.5	.8	.9	.6
11	1.1	.9	.5	.6	.6	.8	27	.9	.8	.5	.8	.9	.6
12	1.2	1.1	.5	.6	1.1	.8	28	.9	.8	.4	.8	.9	.6
13	1.2	1.1	.5	.6	1.1	.8	29	.9	.....	.4	.8	.9	.6
14	1.2	1.0	.5	.6	1.0	.7	30	.9	.....	.4	.8	.8	.6
15	1.2	1.0	.5	.6	.9	.7	31	.9	.....	.4	.....	.8	.....
16	1.2	.9	.5	.6	.9	.6							

NOTE.—Owing to the fragmentary discharge data, daily discharges have not been computed. The creek was probably dry on days when the gage height was less than 0.6 foot.

NORTH FORK OF CANADIAN RIVER NEAR WOODWARD, OKLA.

This station was established September 13, 1903, and was discontinued June 30, 1906. It was located 7 miles east of Woodward, at the railroad bridge. The conditions at the station and the bench marks are described in Water-Supply Paper No. 173, page 67, where are given also references to publications that contain data for previous years.

Discharge measurements of North Fork of Canadian River near Woodward, Okla., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 16	E. Patterson	71	89	2.60	104
March 13	do	64	44	2.50	53
March 26	J. M. Giles	152	158	2.75	210
April 8	do	141	134	2.85	181
April 26	E. Patterson	112	102	2.65	147
May 30	J. M. Giles	72	111	2.65	155
June 24	do	62	81	2.50	108

Daily gage height, in feet, of North Fork of Canadian River near Woodward, Okla., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.6	2.6	2.7	2.8	2.8	2.6	17	2.8	2.9	2.9	2.6	2.5	2.6
2	2.7	2.6	2.6	2.8	2.9	2.7	18	2.7	2.9	2.9	2.7	3.3	2.7
3	2.7	2.6	2.6	2.8	2.8	2.9	19	2.7	3.0	2.9	2.7	3.3	2.6
4	2.7	2.6	2.6	2.8	2.8	2.9	20	2.7	3.0	3.1	2.8	3.1	2.5
5	2.7	2.6	2.6	2.8	2.8	2.8	21	2.6	2.9	2.8	2.8	3.0	2.5
6	2.8	2.7	2.7	2.8	2.7	2.8	22	2.6	2.8	2.8	2.8	2.8	2.5
7	2.7	2.6	2.6	2.8	2.6	2.6	23	2.6	2.8	2.8	2.7	2.9	2.5
8	2.7	2.5	2.8	2.8	2.6	2.6	24	2.6	2.8	2.8	2.7	2.9	2.5
9	2.7	2.4	2.8	2.7	2.6	2.6	25	2.7	2.8	2.8	2.8	2.9	2.6
10	2.5	2.5	2.8	2.7	2.5	2.6	26	2.7	2.8	2.8	2.7	3.0	3.2
11	2.5	2.7	2.8	2.7	2.5	2.6	27	2.7	2.8	2.8	2.6	2.9	3.2
12	2.6	2.6	2.6	2.7	2.5	2.6	28	2.6	2.7	3.0	2.5	2.8	2.7
13	2.8	2.6	2.5	2.7	2.5	2.6	29	2.6	.....	2.9	2.5	2.7	2.7
14	2.8	2.6	2.6	2.6	2.4	2.5	30	2.7	.....	3.0	3.0	2.7	2.6
15	2.8	2.6	2.8	2.6	2.5	2.7	31	2.7	.....	2.9	.....	2.6	.....
16	2.8	2.6	2.8	2.6	2.5	2.7							

Daily discharge, in second-feet, of North Fork of Canadian River near Woodward, Okla., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	87	100	116	195	205	138	17	120	209	192	114	106	140
2	115	100	88	195	246	174	18	120	209	192	145	450	175
3	115	100	88	195	205	255	19	120	250	222	145	450	140
4	115	100	88	180	205	255	20	120	240	314	192	350	108
5	115	100	82	180	205	213	21	92	198	182	192	300	108
6	120	130	108	180	166	213	22	92	160	208	192	210	108
7	115	100	82	162	132	138	23	92	160	208	154	253	108
8	115	74	140	162	132	138	24	92	160	208	164	253	108
9	115	52	140	128	134	138	25	120	160	230	203	253	140
10	62	74	140	128	104	138	26	120	148	230	164	302	400
11	62	130	128	138	104	138	27	120	148	230	130	255	400
12	87	100	73	138	104	140	28	92	116	322	100	213	175
13	120	100	53	138	104	140	29	92	.....	254	100	174	175
14	120	100	73	107	78	108	30	120	.....	300	290	174	140
15	120	100	128	107	104	175	31	120	.....	254	.....	138	.....
16	120	100	154	114	104	175							

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of North Fork of Canadian River near Woodward, Okla., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	120	62	108	6,640
February	250	52	133	7,390
March	322	53	169	10,400
April	290	100	158	9,400
May	450	78	200	12,300
June	400	108	170	10,100
The period	.....	.....	.....	56,200

NOTE.—Values are rated as fair.

NORTH FORK OF CANADIAN RIVER NEAR ELRENO, OKLA.

This station was established October 27, 1902, by W. G. Russell, at the highway bridge 2 miles north of Elreno, Okla. The conditions at this station and the bench marks are described in Water-Supply

Paper No. 173, page 69, where are given also references to publications that contain data for previous years.

Discharge measurements of North Fork of Canadian River near Elreno, Okla., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 8	E. R. Kerby	90	107	2.75	144
January 10	do	53	76	2.50	122
January 29	J. M. Giles	89	97	2.70	112
February 6	E. R. Kerby	65	81	2.65	109
March 13	do	80	99	2.70	117
March 25	J. M. Giles	88	88	2.66	103
April 9	do	105	155	3.55	316
April 18	do	104	116	3.15	213
April 18	Wm. A. Lamb	104	120	3.12	203
April 26	do	100	111	3.02	180
May 12	J. M. Giles	94	103	2.85	142
May 19	do	95	99	2.75	132
May 26	Wm. A. Lamb	104	155	3.40	246
May 28	J. M. Giles	103	136	3.14	211
June 5	Wm. A. Lamb	95	117	2.90	150
June 13	J. M. Giles	95	84	2.70	110
July 3	Wm. A. Lamb	96	99	2.89	147
July 13	do	105	299	4.85	626
July 25	do	111	376	5.52	854
July 25	do	112	511	6.85	1,620
July 25	do	117	639	8.08	2,280
August 13	do	114	522	6.98	1,310
August 15	do	110	353	5.59	820
August 27	J. M. Giles	103	154	3.50	289
September 21	Wm. A. Lamb	109	349	5.40	790
October 17	do	104	175	3.50	283
November 7	do	104	181	3.65	309
December 24	do	108	227	4.25	470

Daily gage height, in feet, of North Fork of Canadian River near Elreno, Okla., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.6	2.8	2.7	3.4	2.9	3.0	3.6	5.6	3.6	3.9	3.8	5.4
2	2.7	2.8	2.6	3.4	3.0	3.0	3.0	5.6	3.5	3.8	3.7	5.8
3	2.7	2.8	2.6	3.5	3.4	2.9	2.9	5.4	3.4	3.6	3.6	6.8
4	2.7	2.8	2.6	3.7	3.6	2.9	2.8	5.2	3.4	3.6	3.6	6.7
5	2.7	2.8	2.6	4.1	3.8	2.9	2.7	4.9	3.3	3.5	3.6	6.3
6	2.6	2.7	2.4	4.0	3.8	2.9	2.9	4.8	3.2	3.4	3.6	5.8
7	2.7	2.6	2.4	3.9	3.5	3.0	2.9	4.6	3.3	3.4	3.6	5.6
8	2.5	2.6	2.3	3.8	3.2	3.3	3.0	6.0	3.6	3.3	3.5	5.3
9	2.5	2.8	2.4	3.6	3.0	3.0	3.4	5.4	3.8	3.3	3.5	5.0
10	2.5	2.8	2.5	3.6	3.0	3.0	3.1	5.4	3.9	3.3	3.5	4.9
11	2.5	2.7	2.5	3.6	2.8	2.8	3.0	5.3	4.0	3.2	3.5	4.8
12	2.8	2.6	2.6	3.5	2.8	2.8	7.5	8.7	4.0	3.2	3.5	4.8
13	2.7	2.6	2.6	3.4	2.8	2.8	4.8	5.6	4.0	3.0	3.5	4.7
14	2.7	2.6	2.7	3.4	2.8	2.8	7.1	5.1	4.5	3.3	3.5	4.6
15	2.7	2.7	2.7	3.3	2.9	2.7	6.1	4.9	4.8	3.4	3.5	4.5
16	2.9	2.7	2.7	3.3	2.8	2.7	5.6	4.7	4.3	3.5	3.5	4.6
17	3.0	2.7	2.5	3.4	2.8	2.8	5.6	4.3	3.5	3.7	3.5	4.6
18	3.0	3.0	2.5	3.1	2.7	2.7	5.1	3.9	3.6	3.7	3.5	4.4
19	3.0	2.9	2.6	3.0	2.7	2.6	4.8	4.2	3.5	3.7	3.4	4.4
20	3.0	3.1	2.6	3.0	2.7	2.6	4.6	3.9	3.5	3.8	3.4	4.3
21	2.9	2.9	2.6	3.0	2.7	2.6	4.3	3.7	3.5	3.8	3.4	4.3
22	2.9	2.8	2.5	3.0	4.2	2.6	4.3	3.5	6.0	3.9	3.4	4.3
23	2.8	2.9	2.5	2.9	4.2	2.6	4.5	3.5	5.4	4.0	3.4	4.3
24	2.8	2.7	2.5	2.9	4.2	2.5	5.2	3.5	5.2	4.3	3.4	4.3
25	2.7	2.6	2.8	3.0	4.1	2.5	4.6	3.5	5.0	4.5	3.4	4.2
26	2.7	2.6	3.0	3.0	3.6	2.5	4.1	3.5	4.9	4.7	3.8	4.2
27	2.7	2.7	3.1	3.0	3.4	2.5	5.8	3.5	4.6	4.5	4.8	4.2
28	2.7	2.8	3.1	2.9	3.1	3.0	6.0	3.6	4.2	4.4	5.0	4.2
29	2.7	.....	3.1	2.9	3.1	3.5	5.9	3.6	4.0	4.4	5.6	4.2
30	2.7	.....	3.2	2.9	3.1	3.8	5.9	3.6	3.9	4.3	5.0	4.2
31	2.7	.....	3.2	.....	3.0	.....	5.8	3.6	.....	4.0	.....	4.2

Rating table for North Fork of Canadian River near Elreno, Okla., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.30	63	3.50	280	4.70	574	5.90	990
2.40	76	3.60	302	4.80	602	6.00	1,030
2.50	90	3.70	325	4.90	631	6.20	1,115
2.60	105	3.80	348	5.00	660	6.40	1,205
2.70	121	3.90	371	5.10	690	6.60	1,300
2.80	138	4.00	395	5.20	725	6.80	1,400
2.90	156	4.10	419	5.30	760	7.00	1,510
3.00	175	4.20	444	5.40	795	7.20	1,630
3.10	195	4.30	469	5.50	830	7.40	1,750
3.20	215	4.40	494	5.60	870		
3.30	236	4.50	520	5.70	910		
3.40	258	4.60	547	5.80	950		

NOTE.—The above table is based on 28 discharge measurements made during 1906 and is well defined

Monthly discharge of North Fork of Canadian River near Elreno, Okla., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	175	90	128	7,870
February	195	105	131	7,280
March	215	63	119	7,320
April	419	156	243	14,500
May	444	121	225	13,800
June	348	90	149	8,870
July	1,810	121	603	37,100
August	2,530	280	599	36,800
September	1,030	215	420	25,000
October	574	175	341	21,000
November	870	258	340	20,200
December	1,400	444	642	39,500
The year	2,530	63	328	239,000

NOTE.—Values are rated as good.

MISCELLANEOUS MEASUREMENTS IN CANADIAN RIVER DRAINAGE BASIN.

Miscellaneous measurements made in Canadian River drainage basin by J. M. Giles in 1906.

Date.	Stream.	Locality.	Area of section.	Discharge.
			Sq. ft.	*Sec.-ft.*
January 31	Canadian River	Bridgeport, Okla	120	150
June 22	Deep Fork of Canadian River	Midlothian, Okla	7	7.4

RED RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The headwaters of Red River include several forks, all of which have their sources in northern Texas. Red River takes a general easterly direction along the northern boundary of Texas, and then turns toward the southeast and flows through a low, swampy region in Louisiana into the Mississippi not far from the southern boundary of the State of Mississippi.

North Fork and Salt Fork rise in the Panhandle of Texas and flow in a general southeasterly course across the southwest corner of Oklahoma, uniting with Prairie Dog Fork a short distance above Vernon, Tex. Elm Fork, rising in the same locality, joins North Fork 50 or 75 miles above its mouth. The flow is very uncertain, most of the run-off being flood water after heavy rains. The flow ceases entirely in the late summer and fall in ordinary dry years. The drainage area consists of dry, semiarid plains varied by sandhills in some portions. The underlying rocks are sandstone, limestone, and gypsum in the upper portion and granite where the streams pass through the Wichita Mountains.

Washita River rises in northern Texas, crosses southern Oklahoma, and flows into Red River in the southern part of Indian Territory, about 10 miles from Denison, Tex.

Sulphur Fork of Red River has its headwaters in Hunt and Fannin counties, Tex., flows eastward, forming the boundary between Delta, Red River, and Bowie counties on the north, and Hopkins, Franklin, Titus, Morris, and Cass counties on the south, and empties into Red River in Arkansas about 7 miles north of the Louisiana boundary line. The flow of this river is very unreliable, changing with the rainfall. If the summer is at all dry it ceases altogether, but enough water always remains standing in pools to water stock. During or immediately after protracted or unusually heavy rains the river becomes very wide and deep, floods its bottoms, and often occasions considerable loss of stock and damage to planters and the railroads.

Big Cypress Creek has its headwaters in Franklin and Titus counties, Tex., flows in a general easterly direction, and empties into Red River. The flow of the river is unreliable, varying with the rainfall. In the summer it ceases and the river becomes dry except where the water stands in holes. After long or heavy rains the stream is liable to overflow its banks.

RED RIVER AT ARTHUR CITY, TEX.

This station was established January 1, 1905. The United States Weather Bureau had maintained a gaging station at this point since 1891. The conditions at the station and the bench marks are described in Water-Supply Paper No. 173, page 72.

Discharge measurements of Red River at Arthur City, Tex., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 17	H. H. Fox	290	2,000	7.6	4,200
March 18	do	506	3,830	11.0	13,100
1906.					
May 6	H. H. Fox			20.0	40,800
May 6	do			19.0	37,000
May 7	do			18.1	32,000
May 8	do			17.0	31,000
May 9	do			15.9	22,300
May 10	do			14.0	17,500
May 11	do			13.2	15,000
May 12	do			11.2	9,000
May 14	do			9.0	7,040
June 21	T. U. Taylor			9.7	7,000
June 22	do			9.4	6,000

Daily gage height, in feet, of Red River at Arthur City, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	8.5	8.2	7.6	7.8	11.5	7.1	7.5	14.6	8.8	10.0	8.0	6.7
2	8.2	8.1	7.2	7.8	15.5	9.95	9.8	12.4	8.6	9.6	8.0	6.7
3	9.0	8.1	7.2	7.8	25.0	10.1	9.7	11.5	9.5	9.4	7.8	6.6
4	9.4	6.6	11.3	7.8	26.0	11.15	9.5	11.0	9.4	9.0	7.7	8.0
5	9.2	6.3	10.9	7.2	23.0	14.05	9.0	10.5	14.5	8.7	7.5	11.3
6	9.2	8.4	9.8	8.0	18.2	18.4	8.6	10.0	13.5	8.4	7.4	10.8
7	11.0	8.4	9.2	8.0	18.2	18.95	8.0	10.6	13.2	8.0	7.2	11.4
8	11.5	8.0	8.7	18.0	17.8	18.8	7.7	11.2	13.2	8.0	7.2	10.6
9	11.5	7.6	9.0	16.5	15.8	16.4	7.3	14.0	13.5	8.0	7.2	10.0
10	11.2	7.6	8.7	14.0	14.2	14.4	7.7	17.5	14.2	7.8	7.1	9.7
11	10.0	7.3	8.5	12.8	13.2	13.5	7.4	17.2	13.0	7.6	7.1	9.6
12	9.8	7.0	8.3	11.5	11.2	13.05	9.3	22.0	11.6	7.4	7.0	9.2
13	7.8	7.0	7.1	9.2	9.5	11.7	12.0	23.0	12.5	7.4	7.0	9.0
14	7.5	15.0	6.8	11.8	9.0	10.9	11.2	22.5	13.3	7.3	7.0	8.9
15	7.0	13.2	6.8	12.0	8.8	10.35	10.3	22.0	15.5	7.9	6.9	8.8
16	6.9	12.4	6.8	12.0	8.5	9.95	9.5	22.5	16.5	8.3	6.9	9.0
17	6.7	12.0	6.5	11.8	17.7	9.55	9.3	20.3	16.6	8.4	6.9	9.6
18	6.7	11.4	6.5	11.8	19.0	9.9	9.0	19.5	16.8	9.0	6.9	9.8
19	6.7	11.0	6.5	9.0	17.0	9.0	9.7	15.7	16.4	13.8	6.8	9.7
20	6.7	10.7	8.9	9.0	15.0	8.65	8.5	14.0	15.6	13.2	7.0	9.4
21	6.3	10.0	9.3	12.0	14.0	9.8	9.2	12.7	15.4	11.8	7.0	9.2
22	6.3	9.7	9.3	12.0	14.0	9.15	9.0	11.9	17.0	10.7	6.9	9.0
23	13.3	9.2	8.2	11.8	11.45	8.65	8.8	10.9	15.0	10.1	7.0	8.8
24	13.7	9.2	7.8	10.5	11.3	8.3	12.8	10.3	13.6	9.8	6.8	8.5
25	9.2	11.5	8.2	9.6	11.1	8.25	11.2	9.8	11.9	9.4	6.8	8.0
26	9.0	10.0	12.0	9.0	11.05	9.25	10.5	9.5	11.4	9.4	6.8	8.0
27	8.8	10.0	11.6	8.0	10.9	8.55	13.0	9.2	11.3	9.6	6.8	7.9
28	8.5	8.0	10.8	8.0	15.4	8.0	12.3	9.7	11.5	9.0	6.8	7.8
29	8.2	.....	10.1	9.8	14.7	7.85	12.5	9.8	10.7	8.5	6.8	7.7
30	8.2	.....	8.2	9.6	12.78	7.4	14.6	9.2	10.4	8.1	6.7	7.6
31	8.2	.....	7.8	.....	10.3	.....	11.7	9.0	.....	8.0	.....	7.5

Rating table for Red River at Arthur City, Tex., for 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
6.30	2,200	7.80	3,870	9.40	6,450	13.00	14,600
6.40	2,290	7.90	4,010	9.60	6,810	14.00	17,650
6.50	2,380	8.00	4,150	9.80	7,170	15.00	21,050
6.60	2,480	8.10	4,300	10.00	7,550	16.00	24,800
6.70	2,580	8.20	4,450	10.20	7,940	17.00	28,700
6.80	2,680	8.30	4,600	10.40	8,340	18.00	32,750
6.90	2,790	8.40	4,760	10.60	8,750	19.00	37,000
7.00	2,900	8.50	4,920	10.80	9,170	20.00	41,400
7.10	3,010	8.60	5,080	11.00	9,600	21.00	45,900
7.20	3,120	8.70	5,240	11.20	10,040	22.00	50,500
7.30	3,240	8.80	5,410	11.40	10,490	23.00	55,200
7.40	3,360	8.90	5,580	11.60	10,950	24.00	60,000
7.50	3,480	9.00	5,750	11.80	11,420	25.00	64,900
7.60	3,610	9.20	6,090	12.00	11,900	26.00	69,900
7.70	3,740						

[a] The Weather Bureau has kept a record of gage heights at this station since 1891, and the above table would give the approximate discharge if applied to them. The measurements of 1905 do not plot consistently with those of 1906, indicating a change of conditions from year to year. The Weather Bureau records indicate that the river stage has been as low as 2.1 feet twice since 1891.

NOTE.—The above table is based on discharge measurements made during 1905–6 and is fairly defined between gage heights 8.0 feet and 20.0 feet. Below 8.0 feet it is only approximate.

Monthly discharge of Red River at Arthur City, Tex., for 1906.

[Drainage area, 40,200 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	16,700	2,200	5,970	367,000	0.149	0.17
February	21,000	2,200	6,940	385,000	.173	.18
March	11,900	2,380	5,350	329,000	.133	.15
April	32,800	3,120	9,430	561,000	.235	.26
May	69,900	4,920	21,000	1,290,000	.522	.60
June	36,800	3,010	11,400	678,000	.284	.32
July	19,600	3,240	7,780	478,000	.194	.22
August	55,200	5,750	20,600	1,270,000	.512	.59
September	28,700	5,080	16,100	958,000	.400	.45
October	17,000	3,240	6,190	381,000	.154	.18
November	4,150	2,580	3,030	180,000	.075	.08
December	10,500	2,480	5,710	351,000	.142	.16
The year	69,900	2,200	9,960	7,230,000	.248	3.37

NOTE.—Values are rated as fair.

NORTH FORK OF RED RIVER NEAR GRANITE, OKLA.

This station was established June 23, 1903, by Fred Bonstedt. It is located at the highway bridge 2 miles east and one-half mile north of Granite, Okla. The Chicago, Rock Island and Pacific Railway crosses the river near this point. The conditions at the station and the bench marks are described in Water-Supply Paper No. 173, page 73, where are given also references to publications that contain data for previous years.

Discharge measurements of North Fork of Red River near Granite, Okla., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 12	E. R. Kerby	55	50	6.15	64
January 25	do	37	35	5.90	38
January 27	J. M. Giles	42	38	5.95	43
February 2	E. R. Kerby	43	34	6.00	46
February 13	do	60	45	6.20	73
February 23	do	54	37	5.95	57
March 7	do	25	14.5	5.55	10
March 21	do	19	7.9	5.53	8
March 22	J. M. Giles	17	8.0	5.55	8
April 11	do	91	79	6.15	114
April 13	Wm. A. Lamb	86	85	6.39	174
April 24	do	69	67	6.40	96
May 5	do	74	45	6.30	70
May 14	do	24	13	5.88	15
May 15	J. M. Giles	27	20	6.05	26
May 16	do	108	97	6.58	204
May 16	do	108	83	6.53	151
May 22	Wm. A. Lamb	49	24	6.11	27
May 23	do	94	48	6.35	63
May 24	do	553	1,530	8.70	4,550
June 2	do	150	85	6.58	162
June 3	do	133	119	6.58	275
June 12	do	37	26	6.10	40
June 14	J. M. Giles	42	33	6.05	44
June 16	do	44	35	6.23	60
June 16	do	45	35	6.20	55
June 17	do	67	56	6.40	97
June 18	Wm. A. Lamb	58	55	6.35	87
June 19	do	48	41	6.20	58
June 20	do	38	34	6.10	46
June 25	do	52	32	6.14	47
June 26	do	190	168	6.82	404
June 27	do	123	97	6.50	211
June 27	do	124	71	6.35	128
July 6	do	13	6	5.79	7
July 11	do	149	166	6.90	362
July 12	do	133	135	6.85	383
July 17	do	325	280	7.28	732
July 19	do	203	130	6.62	251
July 23	do	228	84	6.60	127
July 29	do	370	319	7.55	1,020
July 29	do	420	455	7.80	1,530
August 1	do	142	73	6.60	119
August 6	do	248	174	7.02	523
August 6	do	248	188	6.95	448
August 7	do	174	144	6.75	332
August 11	do	242	216	7.35	623
August 16	do	91	66	6.30	133
August 24	do	17	11	5.75	13
August 28	do	175	124	6.75	252
August 29	do	164	112	6.62	202
September 3	do	108	64	6.30	93
September 19	Lamb and Hutchins	390	404	7.58	1,160
September 26	G. H. Hutchins	76	142	6.45	147
September 27	do	130	115	6.40	123
October 7	do	76	31	6.28	28
October 15	Wm. A. Lamb	540	1,350	9.90	6,900
October 16	do	421	752	8.20	2,920
October 18	G. H. Hutchins	144	354	6.70	827
October 19	do	146	363	6.55	720
October 28	do	179	267	6.45	416
October 29	do	176	266	6.30	418
November 8	do	198	182	6.48	267
November 10	Wm. A. Lamb	138	135	6.60	272
November 25	G. H. Hutchins	261	218	6.90	412
November 26	do	262	533	7.56	1,410
December 26	Wm. A. Lamb	125	95	7.00	121

Daily gage height, in feet, of North Fork of Red River near Granite, Okla., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.05	6.0	5.7	6.20	6.1	6.0	6.1	6.55	6.4	6.4	6.15	7.5
2	6.05	6.0	5.7	6.0	6.85	6.6	6.1	6.5	6.35	6.35	6.15	7.85
3	6.15	5.95	5.4	6.0	6.6	6.6	6.0	6.4	6.3	6.3	6.15	7.85
4	6.2	5.9	5.6	7.0	6.4	6.7	6.0	6.25	7.58	6.2	6.35	7.5
5	6.4	5.8	5.55	7.0	6.3	6.6	5.95	6.8	7.05	6.3	6.4	7.45
6	6.2	5.85	5.6	7.1	6.2	7.05	5.9	7.3	6.9	6.3	6.45	7.15
7	6.1	5.9	5.55	6.8	6.15	6.45	5.8	6.75	6.8	6.3	6.5	7.0
8	6.2	5.8	5.55	6.85	6.15	6.3	5.85	6.9	6.6	6.3	6.45	6.8
9	6.1	5.8	5.5	6.7	6.1	6.1	7.7	6.5	6.65	6.3	6.7	6.8
10	6.1	5.8	5.55	6.4	6.1	6.05	7.65	8.0	6.55	6.4	6.6	6.8
11	6.15	5.9	5.55	6.35	6.0	6.05	6.9	7.6	6.45	6.35	6.55	6.8
12	6.15	5.9	5.6	6.2	6.0	6.05	7.3	7.45	6.4	6.25	6.5	7.05
13	6.05	6.0	5.5	6.5	5.95	6.05	7.6	7.25	6.4	6.25	6.45	7.05
14	6.3	6.35	5.45	6.7	5.9	6.1	8.0	6.6	6.45	7.2	6.5	7.15
15	6.2	6.5	5.35	6.4	6.0	6.25	6.7	6.3	6.55	9.9	6.5	7.2
16	6.1	6.3	5.45	6.2	6.35	6.25	7.9	6.25	8.5	7.75	6.5	6.9
17	6.1	6.15	5.5	6.1	6.5	6.5	7.25	6.15	7.9	7.2	6.5	6.9
18	6.1	6.1	5.55	6.1	6.5	6.45	6.75	6.25	7.95	6.8	6.5	6.8
19	6.1	6.05	5.6	6.0	6.4	6.25	6.55	6.0	7.9	6.55	6.5	7.2
20	6.1	6.3	5.4	6.15	6.35	6.2	6.6	5.95	7.0	6.5	6.55	7.15
21	6.05	6.1	5.6	6.4	6.2	6.35	7.0	5.95	6.85	6.45	6.55	7.05
22	6.0	6.0	5.55	6.7	6.1	6.15	6.75	5.95	6.7	6.45	6.55	6.9
23	5.75	5.9	5.65	6.45	6.2	6.05	6.3	5.95	7.05	6.8	6.6	7.05
24	5.75	5.9	5.8	6.4	8.0	6.15	6.25	5.95	6.6	6.6	6.65	7.0
25	5.9	5.9	6.0	6.3	7.95	6.1	6.25	5.7	6.6	6.55	6.9	7.0
26	5.9	5.8	6.0	6.2	7.1	7.9	6.3	6.3	6.45	6.4	7.35	6.95
27	5.95	5.8	6.0	6.1	6.5	6.5	6.25	6.85	6.4	6.4	7.55	7.0
28	5.9	5.8	6.1	6.0	6.35	6.35	6.2	6.85	6.4	6.35	7.3	7.0
29	5.9	.....	6.15	6.0	6.25	6.25	7.95	6.45	6.4	6.3	7.25	7.0
30	5.95	.....	6.2	6.15	6.2	6.2	7.0	6.5	6.4	6.28	7.35	7.1
31	6.0	.....	6.4	.....	6.15	.....	6.75	6.4	.....	6.2	.....	7.0

NOTE.—Gage heights were estimated September 16 to 30.

Daily discharge, in second-feet, of North Fork of Red River near Granite, Okla., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	52	46	18	125	35	23	63	120	125	60	113	1,360
2	53	46	18	35	365	165	63	90	110	45	113	2,250
3	65	38	2	35	200	275	43	65	90	33	113	2,250
4	73	32	13	500	90	315	43	40	1,180	15	190	1,150
5	113	20	10	500	70	275	34	355	550	33	207	900
6	73	22	13	555	52	560	24	750	420	33	226	725
7	58	32	10	340	43	140	8	330	350	33	245	400
8	73	22	10	370	43	86	15	415	240	33	226	225
9	58	22	7	260	34	40	1,350	195	250	33	327	225
10	58	22	10	175	34	40	1,260	1,920	180	60	287	225
11	65	32	10	162	21	40	385	1,180	145	45	267	225
12	64	32	13	114	21	40	735	950	125	23	247	450
13	52	44	7	200	18	40	1,110	700	125	23	227	450
14	82	101	4	260	15	44	2,480	85	145	900	247	375
15	73	142	1	175	23	73	286	132	180	7,000	247	425
16	58	91	4	125	102	73	2,250	120	3,000	1,950	247	170
17	58	65	7	103	140	160	700	95	1,600	1,180	247	170
18	58	58	10	103	140	140	310	120	1,700	875	247	100
19	58	51	13	85	120	75	218	61	1,600	775	247	450
20	58	91	2	115	95	58	240	50	460	650	247	385
21	52	58	12	175	52	87	450	50	400	220	265	300
22	47	44	8	260	62	43	310	50	300	220	287	170
23	22	37	14	120	52	27	55	50	580	355	287	140
24	22	37	28	96	2,600	47	45	50	250	272	307	125
25	38	37	46	60	2,350	46	45	5	250	254	440	125
26	38	26	46	38	920	2,350	55	132	150	300	1,250	75
27	43	26	46	27	140	211	45	285	130	400	1,420	125
28	38	26	58	20	100	128	40	285	125	380	1,220	125
29	38	.....	65	20	73	67	1,820	172	90	420	1,180	125
30	43	.....	73	32	61	53	450	185	60	415	1,250	175
31	47	.....	113	.....	50	.....	310	159	.....	385	.....	125

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of North Fork of Red River near Granite, Okla., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	113	22	55.8	3,430
February	142	20	46.4	2,580
March	113	1	22.3	1,370
April	555	20	173	10,300
May	2,600	15	262	16,100
June	2,350	23	191	11,400
July	2,480	8	492	30,300
August	1,920	5	297	18,300
September	3,000	60	497	29,600
October	7,000	15	562	34,600
November	1,420	113	414	24,600
December	2,250	75	468	28,800
The year	7,000	1	290	211,000

NORTH FORK OF RED RIVER NEAR HEADRICK, OKLA.

This station was established July 17, 1905. It is located at the Navajo dam site, about 4 miles northeast of Headrick and 8 miles west of Mountain Park, Okla. The conditions at the station and the bench marks are described in Water-Supply Paper No. 173, page 76.

Discharge measurements of North Fork of Red River near Headrick, Okla., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 17	E. R. Kerby	77	182	2.55	143
January 25	J. M. Giles	75	170	2.35	78
January 27	E. R. Kerby	75	182	2.35	89
January 27	do	54	74	2.35	91
January 30	do	54	74	2.35	90
January 30	do	75	182	2.35	90
February 9	do	40	40	2.25	57
February 16	do	82	198	2.90	286
February 20	do	80	138	2.50	136
March 3	do	40	38	2.10	42
March 10	do	35	27	2.07	34
March 16	do	35	26	2.05	32
March 19	J. M. Giles	20	28	2.10	31
March 20	do	40	25	2.10	34
March 24	E. R. Kerby	40	37	2.10	39
March 27	do	52	43	2.30	72
April 10	E. C. Murphy	110	223	3.28	379
April 13	J. M. Giles	98	158	2.90	178
April 15	Wm. A. Lamb	105	199	3.10	283
April 22	do	100	122	2.80	230
May 2	do	223	609	4.55	1,600
May 10	do	80	149	2.75	102
May 16	do	150	553	4.30	1,320
May 19	do	104	414	3.37	301
May 22	J. M. Giles	84	112	3.10	182
May 25	do	260	871	5.27	4,720
May 25	do	260	821	5.07	3,930
May 25	do	259	775	4.92	3,220
May 26	do	179	557	4.34	1,440
May 26	do	169	527	4.23	1,350
May 28	Wm. A. Lamb	110	330	3.45	349
May 30	do	75	294	3.10	206
June 8	do	130	294	3.30	307
June 18	J. M. Giles	155	309	3.44	465
June 20	do	150	256	3.30	385
June 22	Wm. A. Lamb	140	151	2.85	179
June 29	do	130	341	3.30	317
July 7	do	56	48	2.56	73
July 18	do	155	400	3.97	686
July 21	do	230	756	4.85	2,080
July 22	do	130	370	3.73	693
August 3	do	69	226	2.95	173
August 4	do	68	221	2.95	173

Discharge measurements of North Fork of Red River near Headrick, Okla., in 1906—Continued.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 8	Wm. A. Lamb	215	574	4.66	1,610
August 10	do	260	866	5.32	2,700
August 17	do	170	191	2.90	245
August 23	do	110	96	2.50	113
August 29	J. M. Giles	216	347	3.53	484
August 30	Wm. A. Lamb	188	259	3.20	313
September 4	do	195	264	3.22	345
September 7	do	164	304	3.45	424
September 17	do	240	878	5.35	4,200
September 21	G. H. Hutchins	160	471	3.95	953
October 4	do	90	257	2.75	133
October 12	Wm. A. Lamb	95	220	2.70	96
October 13	do	70	80	2.65	91
October 17	G. H. Hutchins	148	496	3.92	1,280
October 21	do	120	257	3.40	490
October 27	do	94	157	3.25	320
November 6	do	97	144	3.15	253
November 12	Hutchins and Lamb	109	140	3.24	220
November 21	G. H. Hutchins	106	100	3.20	164
November 27	do	192	479	4.31	1,270
December 2	do	251	728	5.16	4,350
December 28	Wm. A. Lamb	160	240	3.68	418

Daily gage height, in feet, of North Fork of Red River near Headrick, Okla., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.6	2.4	2.2	2.5	3.6	3.0	3.1	3.6	3.0	2.8	3.15	4.80
2	2.6	2.4	2.2	2.4	4.6	3.2	2.8	3.0	2.9	2.8	3.15	5.16
3	2.6	2.4	2.1	2.3	3.6	4.55	2.7	3.0	3.1	2.7	3.18	5.00
4	2.6	2.4	2.1	2.9	3.6	4.0	2.6	3.0	3.2	2.7	3.20	4.68
5	2.6	2.4	2.1	5.1	3.5	4.4	2.5	3.0	4.9	2.7	3.20	4.60
6	2.8	2.3	2.1	4.5	3.0	4.0	2.5	3.0	3.8	2.72	3.18	4.28
7	2.7	2.3	2.1	4.1	2.9	3.5	2.5	4.9	3.5	2.70	3.22	4.10
8	2.7	2.3	2.1	3.8	2.9	3.2	2.5	4.8	2.3	2.70	3.35	3.95
9	2.7	2.2	2.1	3.3	2.8	3.0	2.5	3.5	2.5	2.70	3.55	3.90
10	2.7	2.2	2.1	3.3	2.7	3.0	5.0	5.3	2.7	2.68	3.42	3.90
11	2.6	2.2	2.1	3.0	2.7	3.0	4.5	5.3	2.7	2.62	3.32	3.88
12	2.6	2.2	2.1	2.9	2.7	2.9	4.8	4.0	2.7	2.61	3.22	3.80
13	2.5	2.2	2.1	2.8	2.6	2.8	4.8	3.9	2.6	2.60	3.20	3.80
14	2.5	2.2	2.1	3.5	2.6	2.8	4.4	3.4	2.7	3.28	3.20	3.88
15	2.5	2.2	2.0	3.0	5.6	3.1	3.5	3.1	3.4	5.58	3.15	3.80
16	2.6	2.9	2.0	3.0	4.2	3.1	3.5	3.0	3.5	4.30	3.18	3.80
17	2.5	2.7	2.0	2.8	3.7	4.2	4.0	2.9	5.2	3.98	3.15	3.75
18	2.5	2.6	2.0	2.7	3.6	3.5	3.6	2.8	4.9	3.88	3.15	3.75
19	2.5	2.5	2.0	2.7	3.6	3.3	3.4	2.7	5.0	3.55	3.15	3.70
20	2.5	2.5	2.0	2.7	3.3	3.0	3.3	2.7	5.0	3.55	3.15	3.70
21	2.5	2.6	2.1	2.7	3.1	3.0	4.8	2.6	4.8	3.42	3.10	3.70
22	2.5	2.6	2.1	3.05	3.2	2.8	3.5	2.4	3.5	3.42	3.25	3.70
23	2.5	2.4	2.1	2.9	3.2	2.8	3.2	2.4	3.7	3.38	3.29	3.70
24	2.5	2.4	2.1	2.7	4.3	2.7	3.1	2.0	4.0	3.65	3.40	3.58
25	2.4	2.3	2.1	2.6	5.1	3.5	3.0	2.0	3.4	3.45	3.52	3.65
26	2.4	2.3	2.1	2.6	4.25	4.0	2.9	2.0	3.3	3.40	3.90	3.60
27	2.4	2.2	2.3	2.5	3.9	5.0	3.0	4.9	3.4	3.30	4.34	3.60
28	2.4	2.2	2.3	2.5	3.4	3.7	3.0	3.8	3.2	3.25	4.40	3.68
29	2.4	.....	2.3	2.6	3.1	3.2	4.6	3.4	2.9	3.22	4.55	3.75
30	2.4	.....	2.3	4.3	3.0	3.1	4.4	3.2	2.8	3.18	5.05	3.75
31	2.4	.....	2.3	.....	3.0	.....	3.6	3.0	.....	3.15	.....	3.70

Daily discharge, in second-feet, of North Fork of Red River near Headrick, Okla., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	160	91	47	110	600	170	220	510	220	135	260	2,420
2	160	92	47	90	1,680	260	120	190	190	135	260	4,350
3	160	93	40	70	600	2,040	95	190	255	100	270	3,840
4	160	94	40	225	600	1,000	80	190	295	100	290	2,840
5	160	95	40	4,080	520	1,680	70	190	2,700	100	290	2,540
6	235	70	40	1,900	260	1,000	70	190	755	100	270	1,530
7	195	70	38	1,160	170	465	70	2,990	465	100	300	1,040
8	195	70	36	755	170	260	70	1,850	70	100	390	760
9	195	47	36	400	130	170	70	440	80	100	560	680
10	195	47	36	400	90	170	3,620	2,680	120	90	435	680
11	160	47	34	290	90	170	1,910	2,680	120	80	375	670
12	160	47	34	260	90	170	2,000	830	120	65	320	550
13	130	47	34	230	60	160	2,000	740	95	65	290	550
14	130	47	34	510	60	160	1,680	380	120	470	290	575
15	130	47	32	290	6,450	480	410	250	380	5,980	255	550
16	160	277	32	290	1,350	480	410	280	460	1,990	270	550
17	130	198	32	230	680	1,250	715	245	3,660	1,370	255	500
18	130	160	31	210	600	520	470	224	2,650	1,220	255	460
19	130	135	31	210	600	335	480	180	3,000	680	135	440
20	130	135	34	210	380	235	315	180	3,000	680	135	440
21	125	160	35	210	280	235	2,000	130	2,430	520	110	440
22	125	160	36	305	320	160	390	95	460	520	305	440
23	120	100	37	225	320	160	240	95	610	460	330	440
24	120	100	38	160	1,320	140	200	20	980	820	390	300
25	90	70	39	130	4,080	520	160	20	395	545	560	240
26	90	70	39	130	1,250	1,000	130	20	340	480	2,700	360
27	90	47	70	115	875	3,620	160	2,000	395	390	1,380	360
28	90	47	70	115	380	685	160	700	295	335	1,430	430
29	90	.....	70	130	260	330	1,600	380	185	310	1,480	490
30	90	.....	70	1,480	220	280	1,240	280	135	265	3,160	490
31	90	.....	70	.....	220	.....	450	220	.....	250	.....	400

NOTE.—Daily discharges obtained by indirect method for shifting channels.

Monthly discharge of North Fork of Red River near Headrick, Okla., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	235	90	140	8,610
February	277	47	95.1	5,280
March	70	31	42.0	2,580
April	4,080	70	497	29,600
May	6,450	60	797	49,000
June	3,620	140	610	36,300
July	3,620	70	697	42,900
August	2,990	20	625	38,400
September	3,660	70	833	49,600
October	5,980	65	599	36,800
November	3,160	110	592	35,200
December	4,350	240	979	60,200
The year	6,450	20	542	394,000

ELM FORK OF RED RIVER NEAR MANGUM, OKLA.

This station was established April 12, 1905. It is located on the highway bridge about 4 miles north of Mangum, Okla. The conditions at the station and the bench marks are described in Water-Supply Paper No. 173, page 79.

Discharge measurements of Elm Fork of Red River near Mangum, Okla., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 12	E. R. Kerby	58	27	2.35	23
January 25	do	50	21	2.25	19
January 27	J. M. Giles	40	18	2.32	22
February 2	E. R. Kerby	50	23	2.25	25
February 13	do	65	31	2.45	34
February 23	do	30	13	2.25	14
March 7	do	30	11	2.25	12
March 21	do	30	13	2.25	14
March 23	J. M. Giles	31	13	2.25	12
March 27	E. R. Kerby	32	14	2.27	17
April 11	J. M. Giles	62	27	2.50	32
April 12	Wm. A. Lamb	61	27	2.45	37
April 24	do	49	22	2.32	22
May 5	do	54	30	2.44	38
May 14	do	50	22	2.31	21
May 15	J. M. Giles	324	1,180	5.38	1,930
May 15	do	176	444	4.42	1,080
May 16	do	106	134	3.25	249
May 22	Wm. A. Lamb	66	37	2.56	38
May 23	do	133	175	3.38	333
May 24	do	350	1,510	6.80	3,980
May 24	do	340	1,180	6.00	2,660
June 2	do	220	511	4.64	1,190
June 3	do	158	199	3.50	335
June 13	do	80	71	2.80	95
June 15	J. M. Giles	85	66	2.83	110
June 16	do	183	384	4.50	892
June 18	Wm. A. Lamb	105	80	2.78	114
June 19	do	100	95	2.91	136
June 20	do	80	47	2.60	53
June 25	do	90	71	2.72	88
June 26	do	259	587	4.92	1,380
June 26	do	222	480	4.58	1,080
June 27	do	116	84	2.82	111
July 5	do	55	27	2.40	24
July 11	do	157	166	3.20	267
July 17	do	135	81	2.80	135
July 19	do	105	40	2.60	53
July 23	do	135	49	2.65	58
August 1	do	90	61	2.70	71
August 6	do	320	733	5.18	1,830
August 7	do	218	424	4.38	905
August 11	do	117	110	3.10	153
August 16	do	77	59	2.75	75
August 24	J. M. Giles	66	39	2.60	48
August 28	Wm. A. Lamb	135	68	2.82	78
August 29	do	90	27	2.78	69
September 3	do	135	95	3.00	137
September 19	do	97	208	3.60	384
September 27	G. H. Hutchins	86	56	2.80	89
October 8	do	87	41	2.70	57
October 16	Wm. A. Lamb	320	1,080	5.95	2,710
October 19	G. H. Hutchins	172	150	3.15	251
October 29	do	116	79	2.90	115
November 7	do	224	416	4.20	979
November 8	do	173	155	3.32	271
November 9	Wm. A. Lamb	137	71	2.90	96
November 26	G. H. Hutchins	204	212	3.58	441
December 26	Wm. A. Lamb	97	97	3.20	156

Daily gage height, in feet, of Elm Fork of Red River near Mangum, Okla., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.4	2.3	2.2	2.2	5.2	2.5	2.4	2.7	2.6	2.8	2.9	4.1
2	2.4	2.2	2.2	2.2	2.8	4.0	2.4	2.6	2.8	2.7	2.9	4.7
3	2.4	2.2	2.2	2.2	2.5	3.6	2.4	2.6	2.6	2.5	2.9	4.1
4	2.5	2.2	2.2	4.8	2.4	3.5	2.4	2.6	4.7	2.6	2.9	3.9
5	2.4	2.2	2.2	6.0	2.6	4.5	2.4	2.9	3.7	2.6	2.9	3.8
6	2.4	2.2	2.2	3.4	2.4	3.0	2.4	5.3	3.0	2.7	2.9	3.7
7	2.4	2.2	2.2	3.0	2.4	2.8	2.4	4.9	2.7	2.7	4.35	3.6
8	2.3	2.2	2.2	3.1	2.4	2.7	2.4	2.9	2.7	2.7	3.3	3.6
9	2.3	2.2	2.2	2.7	2.4	2.5	2.4	5.05	2.7	2.7	3.0	3.5
10	2.3	2.2	2.2	2.6	2.3	2.5	2.6	4.6	2.7	2.6	2.9	3.5
11	2.3	2.2	2.2	2.5	2.3	2.5	3.5	3.3	2.6	2.6	2.9	3.5
12	2.4	2.2	2.2	2.4	2.3	2.6	2.6	6.3	2.8	2.5	2.9	3.5
13	2.4	2.4	2.2	4.2	2.3	2.8	4.0	3.1	2.6	2.5	2.9	3.4
14	2.3	2.4	2.2	2.6	2.3	2.6	3.0	2.9	2.6	5.5	2.9	3.4
15	2.3	2.4	2.2	2.6	5.2	2.5	3.6	2.8	4.0	6.3	2.8	3.4
16	2.3	2.4	2.2	2.5	3.0	4.45	3.9	2.7	3.1	2.4	2.8	3.3
17	2.3	2.3	2.2	2.4	2.8	3.1	2.9	2.7	7.9	3.3	2.9	3.3
18	2.3	2.3	2.2	2.4	2.6	2.7	2.6	2.7	4.0	3.2	2.9	3.3
19	2.3	2.4	2.2	2.4	2.5	3.0	2.5	2.7	4.0	3.1	2.8	3.3
20	2.3	2.4	2.2	2.5	2.6	2.5	5.35	2.7	3.2	3.1	2.8	3.3
21	2.3	2.3	2.2	2.5	3.0	2.5	3.5	2.6	3.1	3.0	3.6	3.3
22	2.3	2.3	2.2	2.5	2.6	2.5	2.7	2.6	3.2	3.0	3.9	3.3
23	2.3	2.3	2.2	2.4	3.4	2.5	2.7	2.6	3.3	3.1	3.0	3.3
24	2.3	2.2	2.2	2.4	5.0	2.4	2.6	2.6	2.9	3.1	2.3	3.2
25	2.3	2.2	2.2	2.3	5.1	2.4	2.5	2.6	2.8	3.0	3.2	3.2
26	2.2	2.2	2.2	2.3	3.2	5.9	2.5	5.0	2.8	2.9	3.1	3.2
27	2.3	2.2	2.3	2.3	2.9	3.0	2.5	4.5	2.9	2.9	3.1	3.2
28	2.3	2.2	2.3	2.2	2.8	2.6	5.1	3.0	2.7	2.9	3.0	3.2
29	2.3	.....	2.3	2.3	2.1	2.5	4.5	2.7	2.7	2.9	4.5	3.2
30	2.3	.....	2.3	2.2	2.8	2.5	3.3	2.8	2.8	2.9	4.1	3.2
31	2.3	.....	2.2	.....	2.1	.....	2.9	2.6	.....	2.9	.....	3.5

Daily discharge, in second feet, of Elm Fork of Red River near Mangum, Okla., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	25	27	14	17	1,730	45	25	70	50	85	115	870
2	25	22	14	17	96	700	25	48	90	59	115	1,300
3	25	22	14	17	48	400	25	48	50	20	115	870
4	30	22	14	1,320	33	335	25	48	1,240	32	115	700
5	25	22	14	2,720	63	890	25	110	475	32	115	600
6	25	22	14	340	33	150	25	1,840	138	59	115	520
7	25	22	14	150	33	95	25	1,430	68	59	1,080	445
8	21	22	14	180	33	77	25	110	68	59	260	445
9	21	22	14	78	33	45	25	1,560	68	59	145	380
10	21	22	14	48	21	45	75	1,150	68	38	115	380
11	21	22	14	32	21	45	380	197	50	38	115	380
12	25	22	14	37	21	60	75	3,160	88	19	115	380
13	25	32	14	840	21	95	700	153	50	19	115	315
14	21	30	14	48	21	60	200	110	50	2,050	115	315
15	21	28	14	48	1,730	45	460	88	700	3,180	90	315
16	21	26	14	32	150	1,020	640	68	165	6	90	215
17	21	20	14	26	90	200	165	68	6,180	350	115	215
18	21	20	14	26	47	96	75	68	700	300	115	210
19	21	20	14	26	38	160	50	68	700	215	90	210
20	21	18	14	32	47	40	1,900	68	200	215	90	210
21	21	16	14	32	150	40	400	50	165	160	445	210
22	21	14	13	32	47	40	103	50	200	160	700	210
23	21	14	12	26	340	40	103	50	235	215	145	210
24	21	14	12	22	1,510	25	75	48	110	215	12	157
25	21	14	12	20	1,620	25	40	48	90	160	215	157
26	18	14	12	20	1,730	2,580	30	1,520	90	115	175	157
27	21	14	17	20	122	150	30	1,060	110	115	175	157
28	21	14	17	18	97	60	1,630	112	70	115	145	155
29	21	.....	17	20	10	45	1,060	60	70	115	1,220	155
30	21	.....	17	18	97	45	196	75	90	115	870	150
31	21	.....	17	.....	10	.....	110	48	.....	115	.....	350

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Elm Fork of Red River near Mangum, Okla., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	30	18	22.2	1,360
February	32	14	20.6	1,140
March	17	12	14.2	873
April	2,720	17	209	12,400
May	1,730	10	324	19,900
June	2,580	25	255	15,200
July	1,900	25	281	17,300
August	3,160	48	438	26,900
September	6,180	50	414	24,600
October	3,180	6	274	16,800
November	1,220	12	248	14,800
December	1,300	155	366	22,500
The year	6,180	6	239	174,000

ELK CREEK NEAR HOBART, OKLA.

This station was established as a regular gaging station September 22, 1904. It is located at the highway bridge about 7 miles south of Hobart, Okla. The conditions and the bench marks are described in Water-Supply Paper No. 173, page 82, where are given also references to publications that contain data for previous years.

Discharge measurements of Elk Creek near Hobart, Okla., in 1903–1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1903.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
September 18	Fred. Bonstedt				14.3
October 22	E. R. Kerby				16.6
November 26	do				18.0
December 22	do				17.0
1904.					
May 6	E. R. Kerby				48
June 9	do				947
August 29	do				22
September 22	Gordon and Kerby	6.4	2.9	0.90	1.8
October 21	Kerby and Johnson	7.3	4.3	.95	3.0
1905.					
January 29	E. R. Kerby	16	14	2.00	10
February 24	Kerby and Whittington	16	33	2.90	33
April 13	E. R. Kerby	20	9.5	2.30	23
April 26	J. M. Giles	21	75	5.60	200
April 27	Murphy and Kerby	19.5	31	3.76	68
May 23	J. M. Giles	17	21	3.00	39
May 31	do	33	151	8.65	403
May 31	do	33	148	8.57	398
July 7	E. R. Kerby	17	11	2.50	24
July 12	do	16	11	2.50	21
July 26	J. M. Giles	16	10	2.52	20
July 26	do	14	11	2.55	21
August 3	E. R. Kerby	14	8	2.25	12
August 25	do	14	8	2.30	13
September 14	do	17	13	2.65	25
September 19	do	16	8	2.30	13
September 23	J. M. Giles	18	13	2.25	11
September 28	E. R. Kerby	15	7	2.20	11
October 14	do	11	4.2	2.10	6
October 26	do	11	4.2	2.20	6
November 28	do		13	2.50	18
December 28	do		14	2.50	17
1906.					
January 18	E. R. Kerby	15	12	2.60	17
January 26	do	16	9.6	2.50	13.2
January 26	J. M. Giles	16	9.0	2.50	13
February 24	E. R. Kerby	16	10	2.50	10

Discharge measurements of Elk Creek near Hobart, Okla., in 1903–1906—Continued.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 21	J. M. Giles	16	10	2.55	12
March 29	E. R. Kerby	17	13	2.70	20
April 11	E. C. Murphy	20.5	15.6	3.03	26
April 16	Wm. A. Lamb	16	16	2.95	32
April 23	do	18	17	3.05	32
April 30	do	20	36	3.75	65
May 7	do	16	10	2.63	21
May 12	do	16	9	2.57	19
May 15	do	32	104	6.95	241
May 21	do	16	12	2.68	26
June 1	do	15	8	2.45	19
June 20	J. M. Giles	16	7.6	2.32	16
July 11	Wm. A. Lamb	52	499	15.49	1,210
July 12	do	42	377	13.61	916
July 20	do	16	27	3.19	41
August 2	do	16	11	2.65	28
August 22	do	18	13	2.30	18
August 28	do	16	38	3.71	67
October 16	do	21	110	6.78	315
November 11	do	17	22	2.70	36

Daily gage height, in feet, of Elk Creek near Hobart, Okla., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.6	2.5	2.5	2.6	3.3	2.4	3.0	2.8	3.3	2.8	2.8	8.2
2	2.6	2.5	2.6	2.6	5.0	3.4	2.9	2.8	3.5	2.8	2.8	8.0
3	2.6	2.5	2.6	2.6	3.6	4.4	2.6	2.7	3.5	2.8	2.8	6.4
4	2.6	2.4	2.6	4.45	2.9	4.1	2.6	2.8	3.4	2.8	2.8	5.8
5	2.7	2.3	2.6	6.55	2.8	5.3	2.6	2.9	3.2	2.8	2.8	5.4
6	2.6	2.3	2.6	8.1	2.7	4.4	2.6	3.9	3.0	2.7	2.8	5.0
7	2.6	2.3	2.6	4.4	2.6	3.0	2.6	5.1	2.5	2.7	2.8	4.3
8	2.6	2.4	2.5	3.5	2.7	2.8	2.5	3.4	2.5	2.7	2.7	4.3
9	2.5	2.4	2.5	3.5	2.7	2.7	2.5	2.9	2.5	2.7	2.7	4.3
10	2.5	2.5	2.5	3.3	2.7	2.6	6.5	2.9	2.5	2.5	2.7	4.3
11	2.6	2.5	2.5	3.0	2.7	2.5	11.4	2.8	2.7	2.5	2.7	4.3
12	2.6	2.5	2.6	2.9	2.7	2.6	14.1	2.8	3.0	2.5	2.6	4.2
13	2.6	2.5	2.6	2.8	2.6	2.8	6.8	2.7	3.4	2.4	2.6	4.1
14	2.6	2.5	2.6	4.3	2.5	2.7	5.1	2.7	3.4	4.6	2.7	4.0
15	2.6	2.5	2.6	3.3	9.1	3.3	3.6	2.6	3.6	6.3	2.7	4.0
16	2.6	2.5	2.5	3.0	3.1	2.7	3.4	2.5	4.0	5.6	2.7	4.0
17	2.6	2.5	2.5	2.9	2.8	2.5	3.4	2.5	3.1	5.1	2.7	3.9
18	2.6	2.5	2.7	2.9	2.6	2.5	3.4	2.5	3.8	4.6	2.7	3.9
19	2.6	2.5	2.7	2.8	2.6	2.4	3.4	2.5	3.8	3.6	2.7	3.8
20	2.6	2.5	2.6	2.9	2.7	2.3	3.4	2.3	5.2	2.9	2.7	3.8
21	2.6	2.5	2.5	2.9	2.7	2.3	3.4	2.3	4.1	2.9	2.8	3.8
22	2.5	2.5	2.6	3.3	2.5	2.3	3.0	2.3	3.9	3.0	2.8	3.6
23	2.5	2.5	2.7	3.1	2.5	2.3	3.0	2.3	3.9	3.0	3.0	3.6
24	2.5	2.5	2.7	2.8	2.5	2.3	3.0	2.3	3.7	3.0	3.0	3.6
25	2.5	2.5	2.7	2.7	3.3	8.3	2.9	2.3	3.2	3.0	4.0	3.6
26	2.5	2.5	2.6	2.7	4.4	9.3	4.2	4.9	3.2	2.9	4.0	3.6
27	2.5	2.5	2.6	2.7	2.9	12.3	4.1	3.2	3.0	2.9	6.1	3.6
28	2.5	2.5	2.6	2.7	2.8	5.3	4.2	2.9	3.0	2.8	6.2	3.5
29	2.4	.....	2.7	2.6	2.5	4.1	3.0	2.7	2.8	2.8	7.4	3.5
30	2.5	.....	2.6	4.7	2.5	3.3	2.9	2.4	2.8	2.8	8.2	3.5
31	2.4	.....	2.6	.....	2.4	.....	2.8	2.2	.....	2.8	.....	3.5

Daily discharge, in second-feet, of Elk Creek near Hobart, Okla., for 1904.

Day.	Sept.	Oct.	Nov.	Dec.	Day.	Sept.	Oct.	Nov.	Dec.
1		2	3	14	17		3	8	14
2		2	3	14	18		3	8	14
3		2	3	14	19		2	8	16
4		2	3	14	20		2	8	16
5		2	3	8	21		2	8	16
6		2	3	8	22	2	2	10	18
7		2	3	8	23	3	2	12	18
8		2	3	10	24	3	2	12	16
9		2	3	10	25	3	2	12	16
10		2	3	12	26	3	2	12	16
11		2	3	14	27	2	2	12	16
12		2	4	14	28	2	2	12	16
13		2	6	14	29	2	2	14	16
14		6	7	16	30	2	2	14	16
15		2	8	16	31		2		16
16		8	8	14					

Daily discharge, in second-feet, of Elk Creek near Hobart, Okla., for 1905–6.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1905.												
1	16	16	14	14	42	644	30	11	11	10	7	14
2	16	16	14	14	24	160	30	13	11	10	7	14
3	16	16	14	18	19	91	30	13	13	10	7	14
4	16	16	14	18	19	97	27	11	11	10	17	14
5	16	16	16	18	17	86	27	11	11	9	11	14
6	16	16	233	18	15	91	24	11	11	9	11	14
7	16	16	103	16	15	86	24	13	11	9	19	14
8	16	16	39	14	17	405	27	13	23	9	15	14
9	16	16	29	14	17	115	30	13	560	9	15	16
10	16	16	23	352	46	91	75	11	275	9	13	16
11	21	16	18	56	17	75	43	11	75	9	11	16
12	21	16	16	36	21	53	33	11	36	7	11	16
13	21	16	16	23	17	57	29	11	29	6	11	18
14	21	16	16	23	39	53	26	378	26	6	11	18
15	21	16	14	21	24	53	21	942	23	6	11	17
16	21	16	21	19	39	50	18	166	19	6	12	19
17	21	18	33	17	15	50	18	51	19	7	12	19
18	21	18	284	21	15	42	16	47	19	7	12	19
19	21	18	200	21	13	42	16	33	13	7	12	17
20	21	18	103	19	13	39	16	29	13	7	12	17
21	21	18	56	17	91	39	14	23	13	5	12	17
22	21	18	36	17	75	39	97	19	13	5	12	17
23	18	103	23	19	27	36	80	16	11	5	44	17
24	18	51	18	219	19	36	51	16	11	6	44	17
25	18	36	16	925	19	33	53	13	11	6	42	17
26	18	18	16	369	275	33	19	13	11	6	42	17
27	18	18	16	63	1,330	33	16	13	11	6	18	17
28	18	14	14	39	2,440	30	13	11	11	8	18	19
29	18	.....	14	30	2,100	30	11	11	11	8	16	19
30	16	.....	12	50	233	30	11	11	11	8	16	19
31	16	.....	14	.....	470	.....	11	11	.....	9	.....	19
1906.												
1	19	12	10	16	45	18	36	34	48	28	39	378
2	19	12	12	16	135	55	32	34	57	28	39	360
3	19	12	13	16	59	109	22	30	57	28	39	233
4	19	10	13	97	30	91	22	34	52	28	39	192
5	22	8	13	244	26	160	22	37	44	28	39	166
6	19	8	13	369	23	109	22	84	36	25	39	140
7	19	7	13	90	21	38	22	146	19	25	39	109
8	19	9	10	45	23	30	19	59	19	25	36	109
9	16	9	10	45	23	27	19	37	19	25	36	109
10	16	11	10	36	23	24	240	37	19	19	36	109
11	18	11	10	25	23	21	699	34	25	19	36	109
12	18	11	13	22	23	24	1,020	34	36	19	33	102
13	18	11	13	21	20	30	261	30	52	16	33	96
14	18	11	13	88	17	27	146	30	52	120	36	92
15	18	11	13	43	460	51	60	27	62	226	36	92

Daily discharge, in second-feet, of Elk Creek near Hobart, Okla, for 1905–6—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1906.												
16	17	11	11	34	42	27	50	23	82	179	36	92
17	17	11	11	30	30	21	50	23	40	150	36	86
18	17	11	15	30	23	21	50	23	72	123	36	86
19	17	10	15	25	23	18	50	23	72	72	36	81
20	17	10	13	28	26	16	50	18	153	43	36	81
21	17	10	11	28	26	16	50	18	87	43	39	81
22	14	10	13	41	21	16	34	18	76	47	39	72
23	13	10	17	34	21	16	35	18	76	47	47	72
24	13	10	17	23	21	16	35	16	67	47	47	72
25	13	10	18	20	51	387	32	16	44	47	92	72
26	13	10	15	22	109	480	96	134	44	43	92	72
27	13	10	14	22	34	800	90	46	36	43	212	72
28	13	10	14	22	30	190	96	32	36	39	219	68
29	10	.....	20	20	21	88	40	25	28	39	309	68
30	13	.....	17	118	21	48	36	16	28	39	378	68
31	10	.....	17	.....	18	.....	32	12	.....	39	.....	68

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Elk Creek near Hobart, Okla., for 1904–1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1904.				
September (22–30)	3	2	2.4	43
October	8	2	2.4	148
November	14	3	7.2	428
December	18	8	14.2	873
The period	.....	.....	.....	1,490
1905.				
January	21	16	18.4	1,130
February	103	14	21.6	1,200
March	284	12	46.9	2,880
April	925	14	83.3	4,960
May	2,440	13	243	14,900
June	644	30	90.6	5,390
July	97	11	29.5	1,810
August	942	11	63.1	3,880
September	560	11	44.1	2,620
October	10	5	7.5	461
November	44	7	16.7	994
December	19	14	16.6	1,020
The year	2,440	5	56.8	41,200
1906.				
January	22	10	16.3	1,000
February	12	7	10.2	566
March	20	10	13.5	830
April	369	16	55.7	3,310
May	460	17	47.4	2,910
June	800	16	98.1	5,840
July	1,020	19	112	6,890
August	146	12	37.0	2,280
September	153	19	51.3	3,050
October	226	16	54.8	3,370
November	378	33	73.6	4,380
December	378	68	113	6,950
The year	1,020	7	56.9	41,400

NOTE.—Valufores 1904 to 1906 are rated as fair.

OTTER CREEK NEAR MOUNTAIN PARK, OKLA.

This station was established April 2, 1903, by G. H. Matthes. It is located on G. M. Dale's homestead, in the SE. ¼ sec. 21, T. 3 N., R. 17 W. of the Indian meridian, and is 2 miles west and 1 mile north of Mountain Park, Okla. The conditions at the station and

the bench marks are described in Water-Supply Paper No. 173, page 83, where are given also references to publications that contain data for previous years.

Discharge measurements of Otter Creek near Mountain Park, Okla., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 16	E. R. Kerby	11	4	1.20	2.8
January 19	do	11	4	1.20	3.0
January 25	J. M. Giles	6	3.4	1.15	2.7
January 28	E. R. Kerby	11	3.5	1.15	2.6
February 8	do	11	4	1.17	3.2
February 21	do	11	4	1.20	3.8
March 2	do	11	2.5	1.15	1.5
March 15	do	11	3.1	1.15	1.7
March 25	do	11	2.5	1.15	1.5
April 10	E. C. Murphy	19	13	1.80	24
April 13	J. M. Giles	16	12	1.61	14
April 15	do	6	4.6	1.52	11
April 22	Wm. A. Lamb	15	12	1.50	8.6
May 2	do	32	38	2.50	68
May 19	do	16	12	1.40	7.6
May 16	do	32	70	3.64	166
May 22	J. M. Giles	14	12	1.45	12
May 24	do	31	40	2.55	76
May 28	Wm. A. Lamb	17	15	1.46	13
May 30	do	16	13	1.35	8.7
June 8	do	15	12	1.30	7.7
June 18	J. M. Giles	28	18	1.72	25
June 29	Wm. A. Lamb	22	19	1.88	27
July 18	do	16	12	1.35	8
August 3	do	8	2.8	1.20	3.7
September 18	Lamb and Hutchins	39	203	6.95	669
September 18	do	49	329	9.25	1,040
October 12	Wm. A. Lamb	16	12	1.40	7.6
December 28	do	17	14	1.50	14

Daily gage height, in feet, of Otter Creek near Mountain Park, Okla., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.2	1.2	1.2	1.2	4.7	1.3	1.6	1.2	1.2	1.5	1.3	4.2
2	1.2	1.2	1.2	1.2	2.5	1.5	1.5	1.2	1.2	1.5	1.3	5.7
3	1.3	1.2	1.2	1.2	2.0	1.7	1.5	1.2	1.2	1.5	1.3	3.6
4	1.2	1.2	1.2	12.4	1.8	1.9	1.4	1.2	1.2	1.5	1.3	2.7
5	1.2	1.2	1.2	12.0	1.6	1.6	1.4	1.3	1.2	1.5	1.3	2.3
6	1.2	1.2	1.2	4.3	1.5	1.5	1.4	1.3	1.6	1.5	1.3	2.1
7	1.2	1.2	1.2	2.7	1.5	1.4	1.4	1.3	1.3	1.4	1.5	2.0
8	1.2	1.2	1.2	2.2	1.5	1.3	1.4	1.5	1.2	1.4	1.5	1.9
9	1.2	1.2	1.2	2.0	1.4	1.3	1.4	1.7	1.2	1.4	1.4	1.8
10	1.2	1.2	1.2	1.8	1.4	1.3	1.9	1.4	1.2	1.4	1.4	1.7
11	1.2	1.2	1.2	1.7	1.4	1.3	2.0	6.0	1.2	1.4	1.3	1.7
12	1.2	1.2	1.2	1.7	1.4	1.6	1.8	2.5	1.2	1.4	1.3	1.7
13	1.2	1.2	1.2	1.6	1.4	1.3	1.5	1.6	10.0	1.4	1.4	1.7
14	1.2	1.2	1.2	1.6	3.55	1.3	1.5	1.4	2.6	5.4	1.4	1.7
15	1.2	1.2	1.2	1.5	7.15	6.2	1.4	1.4	9.25	4.5	1.4	1.6
16	1.2	1.2	1.2	1.5	3.9	4.8	1.4	1.3	4.5	2.8	1.4	1.6
17	1.2	1.2	1.2	1.5	2.4	2.4	1.4	1.3	2.5	2.1	1.4	1.6
18	1.2	1.2	1.2	1.5	1.9	1.8	1.3	1.3	7.85	1.8	1.4	1.6
19	1.2	1.2	1.2	1.5	1.7	1.5	1.3	1.2	8.0	1.6	1.4	1.6
20	1.2	1.2	1.2	1.5	1.5	1.5	1.3	1.2	3.6	1.5	1.4	1.6
21	1.2	1.2	1.2	1.5	1.5	1.4	1.3	1.2	2.4	1.5	1.4	1.6
22	1.2	1.2	1.2	1.5	1.5	1.4	1.3	1.2	2.0	1.5	1.4	1.6
23	1.2	1.2	1.2	1.5	1.5	1.4	1.3	1.2	1.8	1.5	1.4	1.5
24	1.2	1.2	1.2	1.5	2.1	1.4	1.3	1.2	1.7	1.5	1.4	1.5
25	1.2	1.2	1.2	1.4	2.9	8.55	1.3	1.3	1.6	1.4	1.5	1.5
26	1.2	1.2	1.2	1.4	2.0	9.8	1.3	1.4	1.5	1.4	1.9	1.5
27	1.2	1.2	1.2	1.4	1.6	3.4	1.3	1.6	1.5	1.4	1.7	1.6
28	1.2	1.2	1.2	1.4	1.5	2.3	1.3	1.5	1.5	1.4	1.6	1.5
29	1.2	.....	1.2	1.4	1.4	1.9	1.3	1.2	1.5	1.3	5.65	1.5
30	1.2	.....	1.2	11.4	1.4	1.7	1.3	1.2	1.5	1.3	5.8	1.5
31	1.2	.....	1.2	.....	1.4	.....	1.2	1.2	.....	1.3	.....	1.5

Rating tables for Otter Creek near Mountain Park, Okla.

JANUARY 1 TO MAY 15, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.20	2.5	2.50	69	3.80	198	5.20	373
1.30	4.3	2.60	77	3.90	209	5.40	401
1.40	6.5	2.70	85	4.00	220	5.60	430
1.50	10	2.80	94	4.10	232	5.80	460
1.60	14	2.90	104	4.20	244	6.00	490
1.70	19	3.00	114	4.30	256	7.00	645
1.80	24	3.10	124	4.40	268	8.00	810
1.90	30	3.20	134	4.50	280	9.00	980
2.00	36	3.30	144	4.60	293	10.00	1,160
2.10	42	3.40	154	4.70	306	11.00	1,340
2.20	48	3.50	165	4.80	319	12.00	1,520
2.30	55	3.60	176	4.90	332	13.00	1,710
2.40	62	3.70	187	5.00	345	14.00	1,900

MAY 16 TO DECEMBER 31, 1906.[b]

1.20	4	1.70	24	2.20	53	2.70	86
1.30	7	1.80	29	2.30	59	2.80	95
1.40	10	1.90	35	2.40	65	2.90	104
1.50	14	2.00	41	2.50	71	3.00	114
1.60	19	2.10	47	2.60	78		

[a] The above table is based on 15 discharge measurements made during 1906 and earlier high-water measurements. It is fairly well defined.

[b] This table is based on 14 discharge measurements made during 1906 and is fairly well defined below gage height 1.7 feet. Above gage height 3.0 feet the table is the same as the previous one.

Monthly discharge of Otter Creek near Mountain Park, Okla., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	4.3	2.5	2.56	157
February	2.5	2.5	2.50	139
March	2.5	2.5	2.50	154
April	1,600	2.5	173	10,300
May	670	6.5	64.4	3,960
June	1,120	7	116	6,900
July	41	4	11.8	726
August	490	4	25.5	1,570
September	1,160	4	156	9,280
October	401	7	37.3	2,290
November	460	7	40.5	2,410
December	445	14	50.5	3,110
The year	1,600	2.5	56.9	41,000

NOTE.—Values are rated as fair.

HORSE CREEK NEAR MOUNTAIN PARK, OKLA.

This station was established April 17, 1905, and was discontinued June 30, 1906. It was located 5 miles north of Mountain Park, in the SE. ¼ sec. 1, T. 3 N., R. 17 W., of the Indian meridian. The conditions at the station and the bench marks are described in Water-Supply Paper No. 173, page 87.

Discharge measurements of Horse Creek near Mountain Park, Okla., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 28	E. R. Kerby			0.3	0.3
February 8[a]	do			.3	0
March 17	J. M. Giles			.4	0
April 9	E. C. Murphy	4	1.7	.91	1.2
April 14	J. M. Giles	3	.9	.75	.5
April 21	Wm. A. Lamb	3	1.5	.85	1.3
May 3	do	4	1.6	.90	1.3
May 11	do	2.5	.65	.60	.21
May 17	do	4	2.0	.98	1.8
May 24	J. M. Giles	24	75.0	4.90	104
May 29	Wm. A. Lamb	3	.98	.72	.6
June 9	do	2	.6	.60	.3

[a] Frozen.

Daily gage height, in feet, of Horse Creek near Mountain Park, Okla., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.5	0.3	0.4	0.5	1.4	0.6	17	0.4	0.5	0.4	0.65	1.0	0.9
2	.5	.3	.4	.4	1.0	1.0	18	.4	.5	.5	.65	1.0	.8
3	.8	.3	.4	.4	.9	1.1	19	.4	.5	.5	.6	.85	.7
4	.6	.3	.3	5.9	.85	1.4	20	.4	.6	.5	.85	.8	.65
5	.5	(a)	.3	2.5	.75	1.2	21	.4	.5	.5	.85	.75	.6
6	.4	(a)	.4	1.4	.7	.85	22	.4	.5	.5	.8	.7	.6
7	.4	(a)	.4	1.2	.7	.75	23	.4	.5	.5	.7	.8	.7
8	.4	(a)	.4	1.1	.7	.7	24	.4	.5	.5	.6	2.95	.6
9	.4	(a)	.4	.9	.6	.6	25	.3	.5	.5	.6	1.8	6.6
10	.4	.4	.4	.85	.6	.6	26	.3	.5	.5	.6	1.0	3.1
11	.4	.4	.4	.8	.6	.55	27	.3	.4	.5	.55	.85	1.2
12	.4	.6	.4	.8	.6	.95	28	.3	.4	.5	.5	.8	1.0
13	.5	.8	.4	1.0	.6	.75	29	.3	.....	.5	.6	.7	.9
14	.5	.6	.4	.8	3.0	.65	30	.3	.....	.5	4.25	.7	.8
15	.5	.5	.5	.7	2.8	2.7	31	.3	.....	.5	.....	.65	.....
16	.4	.5	.4	.65	1.3	1.8							

[a] Frozen.

Rating table for Horse Creek near Mountain Park, Okla., from April 1 to June 30, 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.40	0	1.60	8	2.80	32	3.90	65
.50	0.1	1.70	9	2.90	35	4.00	68
.60	.3	1.80	10	3.00	38	4.20	76
.70	.5	1.90	12	3.10	41	4.40	84
.80	.9	2.00	14	3.20	44	4.60	92
.90	1.3	2.10	16	3.30	47	4.80	100
1.00	2	2.20	18	3.40	50	5.00	108
1.10	3	2.30	20	3.50	53	5.20	116
1.20	4	2.40	22	3.60	56	5.40	124
1.30	5	2.50	24	3.70	59	5.60	132
1.40	6	2.60	26	3.80	62	5.80	140
1.50	7	2.70	29				

NOTE.—The above table is based on 9 discharge measurements made during 1906 and is well defined between gage heights 0.4 foot and 1.0 foot.

Monthly discharge of Horse Creek near Mountain Park, Okla., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	144	0.0	9.11	542
May	38	.3	4.81	296
June	172	.2	9.49	565
The period				1,400

NOTE.—There was practically no flow during January, February, and March. Values April to June are rated as fair.

DRY FORK OF OTTER CREEK NEAR MOUNTAIN PARK, OKLA.

This station was established April 18, 1905, and was discontinued June 30, 1906. It was located about 4 miles northeast of Mountain Park, Okla., in sec 15, T. 3 N., R. 16 W., of the Indian meridian. The conditions at the station and the bench marks are described in Water-Supply Paper No. 173, page 88.

Discharge measurements of Dry Fork of Otter Creek near Mountain Park, Okla., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 17	E. R. Kerby	6	1.8	0.55	0.9
January 27	do	5	1.3	.55	.8
February 8	do	4	1.2	.55	.7
March 9	do	3	.8	.50	.2
March 17	J. M. Giles	3	.6	.50	.4
April 9	E. C. Murphy	8	3.0	.90	6.2
April 14	J. M. Giles	6	3.4	.70	2.9
April 21	W. A. Lamb	6	1.8	.70	2.3
May 3	do	6	2.9	.85	5.4
May 11	do	5	1.8	.60	2.6
May 17	do	8	4.3	1.00	11.0
May 24	J. M. Giles	21	24.0	1.92	47.0
May 24	do	22	31.0	2.21	67.0
May 29	Wm. A. Lamb	6	2.0	.78	3.7
June 9	do	5	1.5	.60	2.6

Daily gage height, in feet, of Dry Fork of Otter Creek near Mountain Park, Okla., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	0.4	0.5	0.5	0.5	1.0	0.7	17	0.5	0.5	0.5	0.7	1.0	0.8
2	.5	.4	.5	.5	.9	.8	18	.5	.5	.5	.7	.9	.7
3	.5	.4	.5	.5	.85	.8	19	.5	.5	.5	.65	.9	.6
4	.5	.4	.5	3.75	.8	.8	20	.5	.5	.5	.7	.9	.6
5	.4	.4	.5	1.8	.8	.8	21	.5	.5	.5	.7	.8	.5
6	.4	.4	.5	1.3	.75	.7	22	.5	.5	.5	.7	.8	.5
7	.5	.4	.5	1.2	.7	.7	23	.5	.5	.5	.7	.8	.6
8	.5	.4	.5	1.0	.7	.6	24	.5	.5	.5	.7	1.55	.6
9	.5	.4	.5	.9	.7	.6	25	.5	.5	.5	.7	1.05	3.55
10	.5	.4	.5	.8	.7	.6	26	.5	.5	.5	.65	1.0	1.1
11	.5	.5	.5	.8	.6	.6	27	.5	.5	.5	.65	.9	.9
12	.5	.5	.5	.8	.6	.7	28	.5	.5	.5	.6	.9	.8
13	.5	.6	.5	.75	.6	.6	29	.5	.....	.5	.6	.8	.7
14	.5	.5	.5	.7	.6	.6	30	.5	.....	.5	2.3	.8	.7
15	.5	.5	.5	.7	2.2	.85	31	.5	.....	.5	.....	.8	.....
16	.5	.5	.5	.7	1.2	.9							

Rating table for Dry Fork of Otter Creek near Mountain Park, Okla., from April 1 to June 30, 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.50	1	1.40	23	2.30	75	3.20	154
.60	2	1.50	27	2.40	83	3.30	164
.70	3	1.60	31	2.50	91	3.40	174
.80	5	1.70	36	2.60	99	3.50	184
.90	7	1.80	41	2.70	107	3.60	195
1.00	9	1.90	46	2.80	116	3.70	206
1.10	12	2.00	52	2.90	125	3.80	217
1.20	15	2.10	59	3.00	134		
1.30	19	2.20	67	3.10	144		

NOTE.—The above table is based on 10 discharge measurements made during 1906, and is fairly well defined.

Monthly discharge of Dry Fork of Otter Creek near Mountain Park, Okla., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	212	1	14.8	881
May	67	2	8.40	516
June	190	1	9.83	585
The period				1,980

NOTE.—The total discharge for January, February, and March probably did not exceed 100 acre-feet. Values for April to June are rated as approximate.

SALT FORK OF RED RIVER AT MANGUM, OKLA.

This station was established April 11, 1905, and was discontinued June 30, 1906. It was located at the highway bridge one-half mile south of Mangum, Okla. The conditions at the station and the bench marks are described in Water-Supply Paper No. 173, page 91.

Discharge measurements of Salt Fork of Red River at Mangum, Okla., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 12	E. R. Kerby	61	40	2.60	40
January 25	do	45	23	2.40	20
January 27	J. M. Giles	40	21	2.40	22
February 2	E. R. Kerby	50	23	2.45	23
February 13	do	110	81	2.75	109
February 23	do	31	22	2.50	26
March 7	do	10	3.2	2.10	2
March 21	do	6	2	2.00	1
March 23	J. M. Giles	3	0.2	1.90	0.1
March 28	E. R. Kerby	91	5.4	2.55	54
April 11	J. M. Giles	75	71	2.90	55
April 12	Wm. A. Lamb	51	68	2.83	52
April 24	do	38	40	2.90	40
May 5	do	77	60	3.00	78
May 14	do	18	19	2.58	10
May 14	do	165	125	3.10	212
May 15	J. M. Giles	156	327	3.58	677
May 16	do	84	241	2.95	168
May 22	Wm. A. Lamb	53	85	2.45	24
May 23	do	66	129	3.20	206
May 24	do	49	162	3.30	418
June 2	do	147	197	3.55	580
June 3	do	112	130	3.20	186
June 13	do	31	28	2.71	41
June 15	J. M. Giles	42	42	2.90	114
June 16	do	35	28	2.70	39
June 18	Wm. A. Lamb	36	38	2.87	58
June 19	do	41	34	2.81	48
June 20	do	29	19	2.60	16
June 25	do	38	44	2.80	45
June 26	do	31	27	2.50	12

Daily gage height, in feet, of Salt Fork of Red River at Mangum, Okla., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	2.5	2.5	2.2	2.4	3.0	2.7	17	2.5	2.6	1.9	2.7	2.8	2.8
2	2.5	2.5	2.1	2.3	3.0	3.5	18	2.5	2.6	1.9	2.7	2.7	2.8
3	2.5	2.5	2.0	2.3	3.0	3.5	19	2.5	2.6	1.9	2.7	2.6	2.8
4	2.8	2.4	2.0	2.3	3.0	3.5	20	2.5	2.6	1.9	3.1	2.6	2.6
5	2.7	2.3	2.0	3.5	2.9	3.0	21	2.5	2.6	1.9	3.25	2.5	2.5
6	2.5	2.3	2.1	3.5	2.9	2.9	22	2.5	2.5	1.9	3.0	2.4	2.5
7	2.5	2.3	2.1	3.3	2.8	2.8	23	2.5	2.5	1.9	3.0	3.0	2.5
8	2.5	2.3	2.1	3.0	2.7	2.5	24	2.5	2.5	1.9	2.9	3.3	2.5
9	2.5	2.3	2.1	3.0	2.6	2.5	25	2.4	2.4	1.9	2.7	3.3	2.6
10	2.5	2.3	2.0	2.9	2.6	2.5	26	2.4	2.4	1.9	2.7	3.0	2.5
11	2.5	2.3	1.9	2.8	2.5	2.5	27	2.4	2.3	1.9	2.6	2.8	2.4
12	2.5	2.8	1.9	2.8	2.5	2.5	28	2.4	2.2	2.6	2.6	2.6	2.3
13	2.5	2.8	1.9	2.8	2.5	2.5	29	2.5	.....	2.6	2.6	2.5	2.3
14	2.7	2.9	1.9	2.9	3.0	2.5	30	2.5	.....	2.6	2.6	2.3	2.2
15	2.6	2.9	1.9	2.9	3.3	3.3	31	2.5	.....	2.6	.....	2.3	.....
16	2.5	2.8	1.9	2.8	2.9	3.0							

Mean daily discharge, in second-feet, of Salt Fork of Red River at Mangum, Okla., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	30	30	3	35	80	40	17	30	55	1	40	95	65
2	30	30	2	24	80	450	18	30	55	1	40	95	60
3	30	30	1	24	80	450	19	30	55	1	40	60	48
4	62	20	1	24	80	450	20	30	55	1	97	60	16
5	51	12	1	270	60	110	21	30	55	1	103	36	12
6	30	12	2	270	55	81	22	30	26	0.5	58	15	12
7	30	12	2	170	40	60	23	30	26	0.2	58	185	12
8	30	12	2	68	25	25	24	30	26	0.1	20	420	12
9	30	12	2	55	12	25	25	20	17	0.1	20	420	16
10	30	12	1	48	12	25	26	21	8	0.1	20	190	12
11	30	12	1	48	10	25	27	22	5	61	10	118	10
12	30	130	1	48	8	25	28	22	3	61	10	60	8
13	30	130	1	48	8	25	29	30	.....	61	10	36	8
14	51	180	1	60	185	25	30	30	.....	61	10	12	6
15	40	180	1	60	400	240	31	30	.....	61	.....	12	.....
16	30	130	1	48	145	110							

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Salt Fork of Red River at Mangum, Okla., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	62	20	31.6	1,940
February	180	3	47.5	2,640
March	61	0.1	10.8	664
April	270	10	61.2	3,640
May	420	8	99.8	6,140
June	450	6	82.1	4,890
The period	.....	.....	.....	19,900

TURKEY CREEK NEAR OLUSTEE, OKLA.

This station was established April 20, 1905. It is located about 200 feet downstream from William Fullerton's irrigation dam, 6 miles northwest of Olustee, Okla. The conditions at the station and the bench marks are described in Water-Supply Paper No. 173, page 94.

Discharge measurements of Turkey Creek near Olustee, Okla., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 21	E. R. Kerby	8	7.0	2.30	12
February 19	do	16	7.2	2.30	8.7
March 19	do	7	3.2	2.45	15
March 19	J. M. Giles	7	3.2	2.45	16
April 13	do	18	11	2.75	23
April 20	Wm. A. Lamb	20	9	2.55	15
May 18	do	18	11	2.65	15
May 22	J. M. Giles	16	11	2.60	13
May 23	do	20	33	3.92	66
June 8	Wm. A. Lamb	17	12	2.60	16
June 16	J. M. Giles	20	31	3.70	68
July 21	Wm. A. Lamb	16	11	2.60	19
August 9	do	19	56	4.20	129
August 22	J. M. Giles	17	12	2.60	16
September 6	Wm. A. Lamb	17	44	3.05	46
December 29	do	19	43	2.80	30

Daily gage height, in feet, of Turkey Creek near Olustee, Okla., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.3	2.3	2.3	2.3	10.5	2.6	2.5	2.7	2.7	2.6	2.7	4.7
2	2.3	2.3	2.3	2.3	3.2	2.9	2.5	2.7	2.7	2.6	2.7	8.4
3	2.3	2.3	2.3	2.3	4.4	4.55	2.2	2.6	4.7	2.6	2.7	4.8
4	2.3	2.3	2.3	8.3	5.9	2.8	2.5	2.6	5.8	2.6	2.7	3.5
5	2.3	2.3	2.3	15.7	2.9	2.7	2.5	2.6	4.0	2.6	2.7	3.3
6	2.3	2.3	2.3	5.7	2.8	2.7	2.5	3.7	3.1	2.6	2.7	3.2
7	2.3	2.3	2.3	3.0	2.7	2.7	2.5	13.25	2.7	2.6	2.8	3.1
8	2.3	2.3	2.3	2.9	2.7	2.7	2.5	7.8	2.7	2.6	3.0	3.0
9	2.3	2.3	2.3	2.8	2.7	2.7	2.5	5.25	2.7	2.6	2.7	3.0
10	2.3	2.3	2.3	2.7	2.7	2.6	2.7	7.4	2.6	2.6	2.7	2.9
11	2.3	2.3	2.3	2.6	2.7	2.6	2.7	7.6	2.6	2.6	2.7	2.9
12	2.3	2.3	2.3	4.8	2.7	2.6	2.7	3.0	2.6	2.6	2.7	2.9
13	2.3	2.3	2.3	2.7	2.7	2.6	2.6	2.7	2.6	2.6	2.7	2.9
14	2.3	2.3	2.3	2.6	2.6	2.6	2.6	2.7	2.6	7.9	2.7	2.9
15	2.3	2.3	2.3	2.5	3.4	3.1	2.7	2.7	4.6	12.55	2.7	2.8
16	2.3	2.3	2.3	2.4	2.9	3.3	4.2	2.7	2.9	9.0	2.7	2.8
17	2.3	2.3	2.3	2.6	2.7	2.8	2.7	2.6	2.7	3.2	2.7	2.8
18	2.3	2.3	2.3	2.5	2.6	2.6	2.7	2.6	10.55	2.9	2.7	2.9
19	2.3	2.3	2.3	2.5	2.6	3.0	3.0	2.6	10.6	2.9	2.7	2.8
20	2.3	2.3	2.3	2.5	2.6	2.5	3.0	2.6	4.0	2.8	2.7	2.8
21	2.3	2.3	2.3	2.5	2.6	2.5	2.7	2.6	2.8	2.8	2.7	2.8
22	2.3	2.3	2.3	2.5	2.6	2.5	2.7	2.6	2.7	2.8	2.7	2.8
23	2.3	2.3	2.3	2.4	3.7	2.7	2.7	2.6	2.7	2.7	2.7	2.8
24	2.3	2.3	2.3	2.4	6.0	2.6	2.7	2.6	2.7	2.7	2.8	2.8
25	2.3	2.3	2.3	2.3	3.55	2.8	2.7	2.6	2.6	2.7	2.8	2.8
26	2.3	2.3	2.3	2.3	2.7	3.0	2.5	2.6	2.6	2.7	3.1	2.8
27	2.3	2.3	2.3	2.3	2.7	2.5	2.2	2.6	2.6	2.7	2.9	2.8
28	2.3	2.3	2.3	2.3	2.7	2.5	9.55	2.7	2.6	2.7	3.0	2.8
29	2.3	.....	2.3	2.3	2.7	2.5	14.8	2.7	2.6	2.7	6.2	2.8
30	2.3	.....	2.3	12.0	2.7	2.5	6.45	2.7	2.6	2.7	6.2	2.8
31	2.3	.....	2.3	.....	2.6	.....	2.7	2.7	.....	2.7	.....	2.8

WASHITA RIVER AT ANADARKO, OKLA.

This station, established October 25, 1902, by W. G. Russell, is located at the highway bridge one-half mile north of the Anadarko railroad depot. The conditions at this station and the bench marks are described in Water-Supply Paper No. 173, page 95, where are given also references to publications that contain data for previous years.

Discharge measurements of Washita River at Anadarko, Okla., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 11	E. R. Kerby	61	138	2.75	148
January 13	do	61	140	2.80	151
January 24	do	61	130	2.70	126
January 28	J. M. Giles	61	136	2.70	128
January 29	do	61	136	2.70	134
February 1	E. R. Kerby	61	130	2.70	152
February 3	do	61	139	2.70	156
February 14	do	63	152	2.75	172
March 8	do	62	143	2.75	133
March 22	do	62	143	2.73	130
March 24	J. M. Giles	61	135	2.73	128
April 10	do	71	290	4.80	473
April 10	do	71	275	4.68	449
April 17	Wm. A Lamb	68	169	3.60	288
April 17	J. M. Giles	69	163	3.70	304
April 25	Wm. A. Lamb	62	146	3.19	195
May 13	J. M. Giles	64	136	2.95	181
May 14	do	64	130	2.90	160
May 17	do	70	511	7.97	1,210
May 17	do	70	541	8.36	1,240
May 17	do	70	531	8.22	1,220
May 18	do	70	514	7.94	1,100
May 18	do	70	469	7.30	902
May 18	do	70	419	6.60	799
May 19	do	70	282	4.70	464
May 25	Wm. A. Lamb	68	212	4.20	382
June 4	do	68	190	3.90	344
June 13	J. M. Giles	64	146	2.90	181
June 14	do	64	147	2.90	189
June 21	do	63	133	2.66	149
June 21	Wm. A. Lamb	62	129	2.66	142
July 2	do	64	169	3.25	245
July 12	do	70	552	8.65	1,500
July 13	do	70	680	10.40	1,860
July 28	do	70	307	5.85	706
August 12	do	70	264	5.09	565
August 27	do	68	210	3.80	323
September 20	do	70	782	11.26	2,450
October 17	do	70	307	5.05	566
November 9	do	63	174	3.10	216
December 27	do	68	202	3.70	313

Daily gage height, in feet, of Washita River at Anadarko, Okla., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.8	2.7	2.7	2.9	3.5	3.5	3.4	4.6	4.0	3.8	3.1	4.6
2	2.8	2.7	2.7	2.9	5.4	3.35	3.3	5.4	3.7	3.7	3.1	6.4
3	2.8	2.7	2.7	2.8	5.9	3.3	2.95	4.7	3.55	3.6	3.1	6.3
4	2.8	2.7	2.7	3.0	5.6	3.9	2.8	4.4	3.5	3.55	3.1	6.5
5	2.8	2.7	2.7	3.2	5.1	4.6	2.75	5.2	3.5	3.5	3.1	7.2
6	2.8	2.6	2.7	6.6	4.3	4.7	2.75	7.4	4.0	3.45	3.1	6.3
7	2.8	2.6	2.7	12.0	3.6	3.9	2.7	7.1	3.5	3.35	3.1	5.4
8	2.8	2.6	2.7	11.3	3.4	3.6	2.7	6.55	4.25	3.3	3.1	5.1
9	2.7	2.6	2.7	5.9	3.3	3.3	2.7	7.2	3.8	3.25	3.0	4.8
10	2.7	2.6	2.7	4.8	3.2	3.1	2.9	5.3	3.3	3.2	3.0	4.6
11	2.7	2.6	2.7	4.3	3.1	3.0	3.6	5.0	3.2	3.2	3.0	4.4
12	2.7	2.6	2.7	3.9	3.0	3.0	7.75	5.0	3.15	3.1	3.0	4.3
13	2.7	2.7	2.7	3.7	2.9	2.9	10.95	4.7	3.1	3.1	3.0	4.2
14	2.7	2.7	2.7	3.6	2.9	2.9	12.45	5.2	3.45	3.1	3.0	4.1
15	2.8	2.7	2.7	3.7	3.35	2.85	12.7	5.3	4.65	3.2	3.0	4.0
16	2.8	2.8	2.7	3.7	3.7	2.85	12.5	4.8	6.3	3.4	3.0	4.0
17	2.8	2.8	2.7	3.9	8.2	2.85	10.6	4.4	9.7	5.0	3.0	4.0
18	2.7	2.8	2.7	3.5	7.6	2.85	6.7	4.0	12.8	5.6	3.0	4.0
19	2.7	2.8	2.7	3.3	4.7	2.75	6.1	4.1	9.2	4.4	3.0	3.9
20	2.7	2.7	2.7	3.3	3.8	2.7	5.4	4.4	11.0	3.9	3.0	3.9
21	2.7	2.7	2.7	3.3	3.45	2.65	5.1	4.0	11.6	3.3	3.0	3.85
22	2.7	2.7	2.7	3.4	3.35	2.65	4.9	3.75	10.1	3.5	3.0	3.8
23	2.7	2.7	2.7	3.4	5.7	2.55	4.7	3.55	6.3	3.4	3.0	3.75
24	2.7	2.7	2.7	3.2	5.2	2.55	4.7	3.55	5.1	3.4	3.0	3.75
25	2.7	2.7	2.7	3.2	4.3	2.5	4.6	3.5	5.1	3.3	3.0	3.7
26	2.7	2.7	2.7	3.1	4.3	2.5	6.9	3.5	4.8	3.3	3.15	3.65
27	2.7	2.7	2.9	3.0	5.7	2.5	8.7	3.55	4.6	3.3	3.25	3.7
28	2.7	2.7	3.1	3.0	5.1	3.75	6.3	7.5	4.7	3.3	2.4	3.65
29	2.7	.....	3.1	2.9	4.7	4.1	4.9	7.4	4.15	3.25	3.5	3.65
30	2.7	.....	2.9	3.4	4.2	3.6	4.7	5.1	3.75	3.2	3.7	3.6
31	2.7	.....	2.9	.....	3.7	.....	4.4	4.6	.....	3.15	.....	3.6

Rating table for Washita River at Anadarko, Okla., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.50	110	4.10	378	5.70	668	8.60	1,377
2.60	126	4.20	396	5.80	687	8.80	1,443
2.70	142	4.30	414	5.90	706	9.00	1,510
2.80	158	4.40	432	6.00	725	10.00	1,880
2.90	174	4.50	450	6.20	765	11.00	2,280
3.00	190	4.60	468	6.40	805	12.00	2,700
3.10	207	4.70	486	6.60	846	13.00	3,150
3.20	224	4.80	504	6.80	888	14.00	3,600
3.30	241	4.90	522	7.00	930	15.00	4,050
3.40	258	5.00	540	7.20	975	16.00	4,500
3.50	275	5.10	558	7.40	1,024	17.00	5,000
3.60	292	5.20	576	7.60	1,077	18.00	5,500
3.70	309	5.30	594	7.80	1,132	19.00	6,000
3.80	326	5.40	612	8.00	1,190		
3.90	343	5.50	630	8.20	1,251		
4.00	360	5.60	649	8.40	1,313		

NOTE.—The above table is based on 41 discharge measurements made during 1906 and is fairly well defined between gage heights 2.6 feet and 11.2 feet. The extension of the table has been applied to the 1905 gage heights above 7.0 feet, and the monthly discharges as recomputed are given below.

Monthly discharge of Washita River at Anadarko, Okla., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
January (24 days)	144	105	124	5,900
February (16 days)	395	144	226	7,170
March (29 days)	730	191	319	18,300
April (29 days)	2,280	202	556	32,000
May	5,900	274	1,270	78,100
June	5,850	250	992	59,000
July	544	180	252	15,500
August	1,730	120	418	25,700
September	1,380	135	368	21,900
October	134	85	109	6,700
November	880	104	227	13,500
December	333	158	187	11,500
The period				295,000
1906.				
January	158	142	148	9,100
February	158	126	140	7,780
March	207	142	149	9,160
April	2,700	158	446	26,500
May	1,250	174	441	27,100
June	486	110	222	13,200
July	3,020	142	828	50,900
August	1,050	275	547	33,600
September	3,060	207	749	44,600
October	649	207	279	17,200
November	309	190	206	12,300
December	975	292	449	27,600
The year	3,060	110	384	279,000

NOTE.—The above values for 1905 supersede those given in Water-Supply Paper No. 173. They are more accurate owing to the availability of new data since the first publication in the 1905 report. Values are rated as follows: 1905, and January to March, 1906, fair; April to December, 1906, good.

OUACHITA RIVER AT ARKADELPHIA, ARK.

This station was established August 1, 1905. It is located at the bridge of the St. Louis, Iron Mountain and Southern Railway at Arkadelphia, Ark. The conditions at the station and the bench marks are described in Water-Supply Paper No. 173, page 99.

Discharge measurements of Ouachita River at Arkadelphia, Ark., in 1906.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
May 5	J. R. Nagle	17.4	25,500
May 6	do	12.15	15,800
Do	do	11.6	15,600
May 7	do	10.3	13,000
Do	do	10.1	12,600
Do	do	9.5	11,200
June 2	T. U. Taylor	4.6	1,600
June 20	do	3.2	520

Daily gage height, in feet, of Ouachita River at Arkadelphia, Ark., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.4	5.1	6.2	9.4	4.0	3.5	3.0	4.8	3.8	4.9	3.0	3.9
2	6.1	4.5	5.9	7.8	5.1	4.6	3.0	4.6	3.5	4.1	2.9	3.9
3	10.85	4.7	6.1	7.0	16.75	4.6	3.0	4.1	3.4	3.8	2.9	3.7
4	14.15	4.6	5.8	6.4	20.6	4.6	2.9	3.7	3.3	3.6	2.9	3.6
5	11.2	4.7	5.5	6.3	18.55	4.5	2.9	3.5	3.3	3.5	2.9	3.6
6	8.5	4.7	5.2	6.9	11.6	4.4	2.8	3.4	3.2	3.4	2.9	3.5
7	7.3	4.6	5.1	6.3	9.5	4.4	2.8	3.4	3.8	3.3	2.9	3.4
8	6.7	4.5	5.3	6.0	8.1	4.3	2.9	3.6	3.7	3.1	2.8	3.4
9	6.1	4.4	5.4	5.6	7.0	4.3	3.0	3.4	3.5	3.0	2.8	3.6
10	5.7	4.3	5.3	5.4	6.3	4.3	3.1	3.3	3.5	3.0	2.8	3.9
11	5.5	4.2	5.1	5.1	5.8	4.0	3.3	4.1	3.3	3.0	2.8	3.9
12	5.2	4.1	4.9	5.0	5.4	3.8	3.3	4.5	3.5	2.9	2.8	3.8
13	5.0	4.3	4.8	5.0	5.1	3.6	4.6	3.8	3.3	2.9	2.8	3.7
14	4.9	4.6	5.0	4.9	4.8	3.5	6.1	4.9	3.7	2.8	2.8	3.6
15	4.8	4.8	7.2	8.2	4.6	3.4	5.8	4.7	3.3	3.7	2.8	10.0
16	4.6	5.1	6.8	6.5	4.4	3.4	5.0	3.7	4.5	4.5	2.8	16.55
17	4.4	5.0	6.3	5.7	4.2	3.3	6.7	3.7	4.0	4.6	3.8	18.6
18	4.3	4.8	5.8	5.2	4.1	3.3	5.2	3.4	3.6	4.3	6.3	17.6
19	4.2	4.8	6.8	4.9	4.0	3.5	4.7	3.3	3.4	4.0	5.4	11.8
20	4.1	4.9	7.7	4.7	3.9	3.3	4.2	3.4	3.4	4.0	7.7	8.5
21	6.9	5.4	7.1	4.6	3.8	3.3	3.9	3.3	3.6	3.8	7.9	7.1
22	17.05	6.1	6.5	4.9	3.7	3.7	5.7	3.4	3.5	3.7	7.1	6.4
23	19.65	6.1	6.0	4.7	3.7	3.7	5.8	4.1	3.3	3.6	6.5	5.9
24	14.8	8.1	5.7	4.5	3.8	3.5	4.8	3.7	3.1	3.4	5.9	5.7
25	8.7	11.7	6.4	4.4	3.8	3.9	4.3	3.5	3.0	3.3	5.3	5.3
26	7.6	9.5	7.5	4.2	3.7	3.6	3.9	3.6	3.9	3.2	5.0	5.2
27	6.9	7.7	8.2	4.1	3.7	3.4	3.9	4.0	3.4	3.1	4.7	5.0
28	6.5	6.7	8.3	4.1	3.6	3.3	6.3	3.6	3.4	3.0	4.4	5.3
29	6.0	.....	9.4	4.0	3.5	3.2	9.3	5.5	4.9	3.1	4.3	5.7
30	5.6	.....	16.65	4.1	3.5	3.1	6.3	4.8	4.7	3.0	4.1	6.0
31	5.3	.....	14.1	.....	3.4	.....	5.2	4.2	.....	3.0	.....	6.1

Rating table for Ouachita River at Arkadelphia, Ark., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.30	50	3.00	420	4.70	1,850	7.80	7,590
1.40	55	3.10	470	4.80	1,980	8.00	8,000
1.50	60	3.20	520	4.90	2,110	9.00	10,050
1.60	70	3.30	580	5.00	2,240	10.00	12,100
1.70	80	3.40	640	5.20	2,540	11.00	14,150
1.80	90	3.50	710	5.40	2,860	12.00	16,200
1.90	105	3.60	780	5.60	3,200	13.00	18,250
2.00	120	3.70	850	5.80	3,560	14.00	20,300
2.10	140	3.80	930	6.00	3,950	15.00	22,350
2.20	160	3.90	1,010	6.20	4,350	16.00	24,400
2.30	185	4.00	1,100	6.40	4,750	17.00	26,450
2.40	210	4.10	1,190	6.60	5,150	18.00	28,500
2.50	240	4.20	1,290	6.80	5,550	19.00	30,550
2.60	270	4.30	1,390	7.00	5,950	20.00	32,600
2.70	305	4.40	1,500	7.20	6,360	21.00	34,650
2.80	340	4.50	1,610	7.40	6,770		
2.90	380	4.60	1,730	7.60	7,180		

NOTE.—The above table is based on 8 discharge measurements made during 1906 and is fairly defined above gage height 3.0 feet. Below 3.0 feet it is liable to large error.

Monthly discharge of Ouachita River at Arkadelphia, Ark., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
August	3,380	50	301	18,500
September	1,730	305	630	37,500
October	11,100	380	1,870	115,000
November	15,600	1,100	4,970	296,000
December	22,600	640	6,720	413,000
The period				880,000
1906.				
January	31,900	1,190	7,380	454,000
February	15,600	1,190	3,380	188,000
March	25,700	1,980	5,740	353,000
April	10,900	1,100	3,370	201,000
May	33,800	640	5,340	328,000
June	1,730	470	964	57,400
July	10,700	340	2,050	126,000
August	3,030	580	1,090	67,000
September	2,110	420	815	48,500
October	2,110	305	758	46,600
November	7,800	340	1,830	109,000
December	29,700	640	5,530	340,000
The year	33,800	305	3,190	2,320,000

NOTE.—Values 1905–6 are rated as good.

MISCELLANEOUS MEASUREMENTS IN RED RIVER DRAINAGE BASIN.

Sulphur Creek is formed by the junction of Antelope Springs and Buffalo Springs near Sulphur, Ind. T. It is tributary to Washita River through Rock Creek.

The following measurements were made January 7, 1907, by N. C. Grover:

Miscellaneous measurements in Red River drainage basin in 1907.

Stream.	Locality.	Width.	Area of section.	Discharge.
		Feet.	*Sq. ft.*	*Sec.-ft.*
Antelope Springs	Above junction	7.4	4.9	3.22
Do	do	6.7	2.7	3.42
Buffalo Springs	do	10.5	5.5	6.11
Sulphur Creek	Below junction	12.2	7.6	10.7

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CLASSIFICATION OF THE PUBLICATIONS OF THE UNITED STATES GEOLOGICAL SURVEY.

[Water-Supply Paper No. 209.]

The publications of the United States Geological Survey consist of (1) Annual Reports; (2) Monographs; (3) Professional Papers; (4) Bulletins; (5) Mineral Resources; (6) Water-Supply and Irrigation Papers; (7) Topographic Atlas of United States, folios and separate sheets thereof; (8) Geologic Atlas of United States, folios thereof. The classes numbered 2, 7, and 8 are sold at cost of publication; the others are distributed free. A circular giving complete lists can be had on application.

Most of the above publications can be obtained or consulted in the following ways:

1. A limited number are delivered to the Director of the Survey, from whom they can be obtained, free of charge (except classes 2, 7, and 8), on application.

2. A certain number are delivered to Senators and Representatives in Congress for distribution.

3. Other copies are deposited with the Superintendent of Documents, Washington, D. C., from whom they can be had at practically cost.

4. Copies of all Government publications are furnished to the principal public libraries in the large cities throughout the United States, where they can be consulted by those interested.

The Professional Papers, Bulletins, and Water-Supply Papers treat of a variety of subjects, and the total number issued is large. They have therefore been classified into the following series: A, Economic geology; B, Descriptive geology; C, Systematic geology and paleontology; D, Petrography and mineralogy; E, Chemistry and physics; F, Geography; G, Miscellaneous; H, Forestry; I, Irrigation; J, Water storage; K, Pumping water; L, Quality of water; M, General hydrographic investigations; N, Water power; O, Underground waters; P, Hydrographic progress reports; Q, Fuels; R, Structural materials.

Series P.—The hydrographic progress reports contain the results of stream measurements. A report is issued for every calendar year, containing the results of data collected during that year. These reports were first published as a part of the Director's annual report or as a bulletin; they are now published as water-supply and irrigation papers. The following is a list, by years, of the publications containing the progress reports of stream measurements (* means out of stock). A detailed index of these reports (1888–1903) is published as Water-Supply Paper No. 119.

1888. Tenth Annual Report, Part II*.
1889. Eleventh Annual Report, Part II*.
1890. Twelfth Annual Report, Part II*.
1891. Thirteenth Annual Report, Part III*.
1892. Fourteenth Annual Report, Part II*.
1893. Bulletin No. 131*.
1894. Bulletin No. 131*; Sixteenth Annual Report, Part II*.
1895. Bulletin No. 140*.
1896. Water-Supply Paper No. 11*, Eighteenth Annual Report, Part IV*.
1897. Water-Supply Papers Nos. 15* and 16*; Nineteenth Annual Report, Part IV*.
1898. Water-Supply Papers Nos. 27* and 28*; Twentieth Annual Report, Part IV*.
1899. Water-Supply Papers Nos. 35*, 36*, 37*, 38*, and 39*; Twenty-first Annual Report, Part IV*.
1900. Water-Supply Papers Nos. 47, 48, 49, 50, 51, and 52; Twenty-second Annual Report, Part IV.
1901. East of Mississippi River, Water-Supply Papers Nos. 65* and 75*.
West of Mississippi River, Water-Supply Papers Nos. 66 and 75*.

SERIES LIST.

1902. East of Mississippi River, Water-Supply Papers Nos. 82 and 83.
West of Mississippi River, Water-Supply Papers Nos. 84 and 85.
1903. East of Mississippi River, Water-Supply Papers Nos. 97 and 98.
West of Mississippi River, Water-Supply Papers Nos. 99 and 100.
1904. East of Mississippi River, Water-Supply Papers Nos. 124, 125, 126, 127, 128, and 129.
West of Mississippi River, Water-Supply Papers Nos. 130, 131, 132, 133, 134, and 135.
1905. East of Mississippi River, Water-Supply Papers Nos. 165*, 166*, 167, 168*, 169, 170, and 171.
West of Mississippi River, Water-Supply Papers Nos. 171, 172*, 173*, 174, 175*, 176, 177, and 178.
1906. East of Mississippi River, Water-Supply Papers Nos. 201, 202, 203, 204, 205, 206, and 207.
West of Mississippi River, Water-Supply Papers Nos. 207, 208, 209, 210, 211, 212, 213, and 214.

Correspondence should be addressed to

THE DIRECTOR,
UNITED STATES GEOLOGICAL SURVEY,
WASHINGTON, D. C.

SEPTEMBER, 1907.

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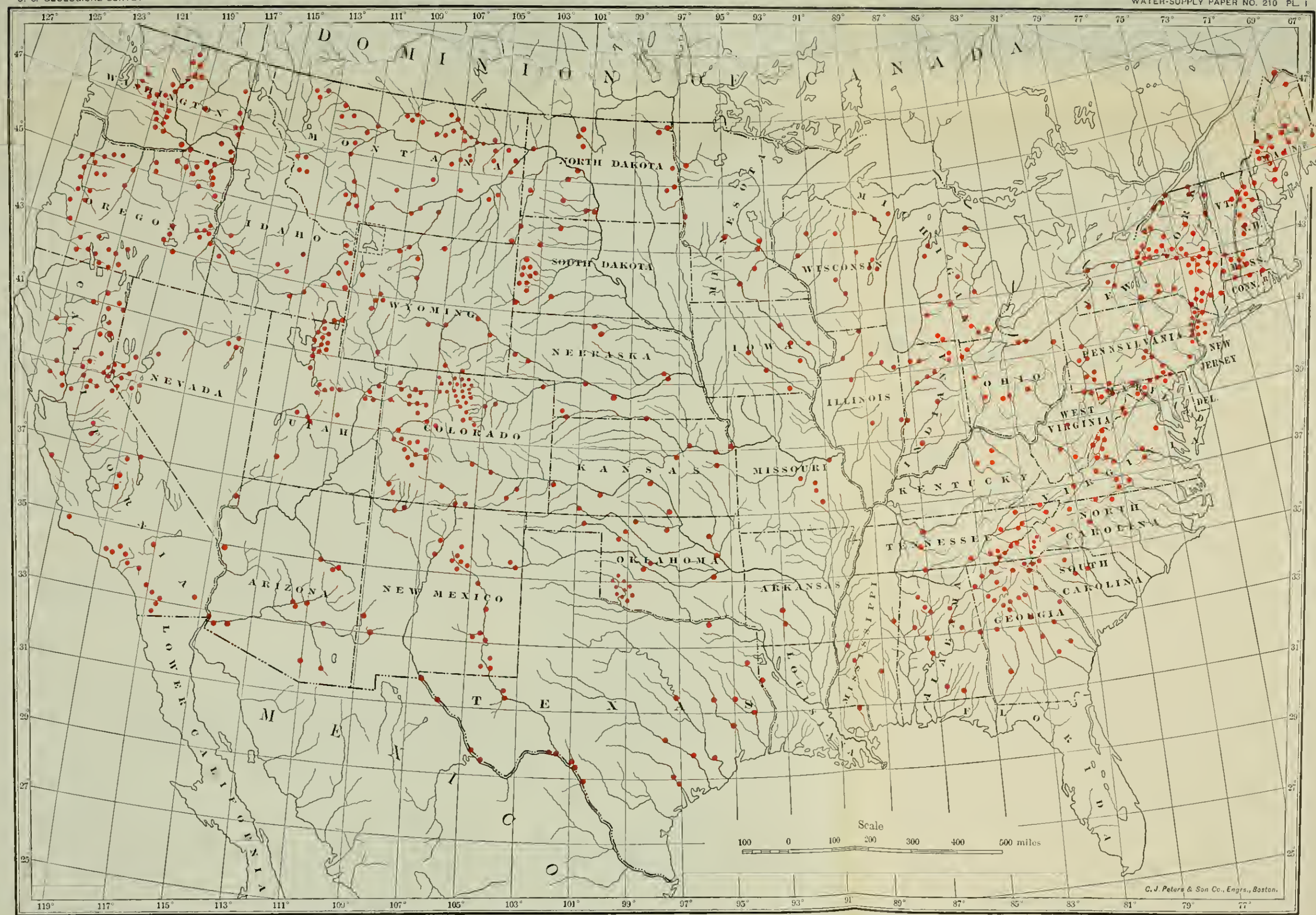

MAP OF UNITED STATES SHOWING LOCATION OF PRINCIPAL RIVER STATIONS MAINTAINED DURING 1906.

Water-Supply and Irrigation Paper No. 210 Series P, Hydrographic Progress Reports, 64

DE ARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

SURFACE WATER SUPPLY OF WESTERN GULF OF MEXICO AND RIO GRANDE DRAINAGES 1906

T. U. TAYLOR AND W. A. LAMB
DISTRICT HYDROGRAPHERS

WASHINGTON
GOVERNMENT PRINTING OFFICE
1907

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SURFACE WATER SUPPLY OF GULF OF MEXICO AND RIO GRANDE DRAINAGES, 1906.[a]

T. U. Taylor and W. A. Lamb,
District hydrographers.[b]

INTRODUCTION.

SCOPE OF WORK.

The water supply of the United States is of more importance to the life and pursuits of the people than any other natural resource. In the arid States the limit of agricultural development is determined by the amount of water available for irrigation, while in all parts of the country the increase in the population of cities and towns makes necessary additional water supplies for domestic and industrial uses, in procuring which both the quantity and the quality of the water that may be obtained must be considered. The location of manufacturing plants may depend largely on the water-power facilities and on the character of the water. The notable advances made in the electric transmission of power have led to the utilization of water powers for the operation of manufacturing establishments, railroads, and municipal lighting plants, many of which are at some distance from the places at which the power is developed.

The intelligent establishment and maintenance of enterprises or industries that depend on the use of water demands a thorough knowledge of the flow of the streams and an understanding of the conditions affecting that flow. This knowledge should be based on data showing both the total flow and the distribution of the flow throughout the year, in order that normal fluctuations may be provided for. As the flow of a stream is variable from year to year, estimates of future flow can be made only from a study of observations covering several years. The rapid increase in the development of the water

[a] This report contains information similar to that published in previous years under title "Report on the Progress of Stream Measurements."

[b] The data in this report were collected as follows: In the eastern portion under the direction of Prof. T U. Taylor, of the University of Texas; in the western portion under the direction of W. B. Lamb. The stations on the Rio Grande proper were maintained by the International (Water) Boundary Commission, under the direction of W. W. Follett, consulting engineer.

The data were prepared for publication under the direction of John C. Hoyt, assisted by R. H. Bolster, J. E. Stewart, F. F. Henshaw, and H. D. Padgett.

resources of the United States has caused a great demand by engineers for information in regard to the flow of streams, as it is now generally realized that the failure of many large power, irrigation, and other projects has been due to the fact that the plans were made without sufficient trustworthy information in respect to the water supply.

Owing to the broad scope of these hydrographic investigations and the length of time they should cover in order that the records may be of greatest value, it is in general impossible for private individuals to collect the necessary data, and as many of the streams traverse more than one State this work does not properly fall within the province of the State authorities. The United States Geological Survey has, therefore, by means of specific appropriations by Congress, for several years systematically made records of stream flow, with the view of ultimately determining all the important features governing the flow of the principal streams of the country. In carrying out this plan stations are established on the streams and maintained for a period long enough to show their regimen or general behavior. When a record that is sufficient for this purpose has been obtained for any stream, the work on that stream is discontinued. The order in which the streams are measured is determined by the degree of their importance.

During 1906 the regimen of flow was studied at about 700 stations distributed along the various rivers throughout the United States, as shown on Pl. I. In addition to these records data in regard to precipitation, evaporation, water power, and river profiles were obtained in many sections of the country.

These data have been assembled by drainage areas and are published in a series of fourteen Water-Supply and Irrigation Papers, Nos. 201 to 214, inclusive, each of which pertains to the surface water resources of a group of adjacent areas. In these papers are embodied not only the data collected in the field, but also the results of computations based on these data and other information that has a direct bearing on the subject, such as descriptions of basins and the streams draining them, utility of the water resources, etc. The list follows.

Water-Supply and Irrigation Papers on surface water supply, 1906.

201. Surface water supply of New England, 1906. (Atlantic coast of New England drainage.)
202. Surface water supply of the Hudson, Passaic, Raritan, and Delaware river drainages, 1906.
203. Surface water supply of the Middle Atlantic States, 1906. (Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages.)
204. Surface water supply of the Southern Atlantic and Eastern Gulf States, 1906. (Santee, Savannah, Ogeechee, and Altamaha rivers, and eastern Gulf of Mexico drainages.)
205. Surface water supply of the Ohio and lower eastern Mississippi river drainages, 1906.

206. Surface water supply of the Great Lakes and St. Lawrence River drainages, 1906.
207. Surface water supply of the upper Mississippi River and Hudson Bay drainages, 1906.
208. Surface water supply of the Missouri River drainage, 1906.
209. Surface water supply of the lower western Mississippi River drainage, 1906.
210. Surface water supply of the western Gulf of Mexico and Rio Grande drainages, 1906.
211. Surface water supply of the Colorado River drainage above Yuma, 1906.
212. Surface water supply of the Great Basin drainage, 1906.
213. Surface water supply of California, 1906. (The Great Basin and Pacific Ocean drainages in California and Colorado River drainage below Yuma.)
214. Surface water supply of the North Pacific Coast drainage, 1906.

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing such records up to and including 1903 has been published in Water-Supply Paper No. 119. The following table gives, by years and primary drainage basins, the numbers of the papers on surface water supply published from 1901 to 1906:

Numbers of Water-Supply Papers containing results of stream measurements, 1901–1906.[a]

	1901.	1902.	1903.	1904.	1905.	1906.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
Atlantic coast of New England drainage	65, 75	82	97	124	165	201
Hudson, Passaic, Raritan, and Delaware river drainages	65, 75	82	97	125	166	202
Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages	65, 75	82, 83	97, 98	126	167	203
Santee, Savannah, Ogeechee, and Altamaha rivers and eastern Gulf of Mexico drainages	65, 75	83	98	127	168	204
Ohio and lower eastern Mississippi river drainages	65, 75	83	98	128	169	205
Great Lakes and St. Lawrence River drainages	65	83	97	129	170	206
Hudson Bay and upper eastern and western Mississippi River drainages	65, 66, 75	83, 84, 85	98, 99, 100	128, 130	171	207
Missouri River drainage	66, 75	84	99	130, 131	172	208
Meramec, Arkansas, Red, and lower western Mississippi river drainages	66, 75	84	99	131	173	209
Western Gulf of Mexico and Rio Grande drainages	66, 75	84	99	132	174	210
Colorado River drainage, above Yuma	66, 75	85	100	133	175	211
The Great Basin drainage	66, 75	85	100	133	176	212
The Great Basin and Pacific Ocean drainages in California, and Colorado River drainage, below Yuma	66, 75	85	100	134	177	213
North Pacific Coast drainage	66, 75	85	100	135	178	214

[a] Reports containing data for years prior to 1901 are noted in the series list at the end of this paper.

DEFINITIONS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups: (1) Those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet per square mile, and (2) those which represent the actual quantity of water,

as run-off in depth in inches and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the quantity of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed.

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the quantity of water that passes through an orifice 1 inch square under a head which varies locally. It has been commonly used by miners and irrigators throughout the West and is defined by statute in each State in which it is used.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

"Acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. It is commonly used in connection with storage for irrigation work. There is a convenient relation between the second-foot and the acre-foot: One second-foot flowing for twenty-four hours will deliver 86,400 cubic feet, or approximately 2 acre-feet.

EXPLANATION AND USE OF TABLES.

For each regular gaging station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of monthly and yearly discharges and run-off.
6. Tables showing discharge and horsepower and the number of days during the year when the same are available.

The descriptions of stations give such general information about the locality and equipment as would enable the reader to find and use the station, and they also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, name of the

hydrographer, width and area of cross section, gage height, and discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. At most stations the gage is read in the morning and in the evening.

The discharge measurements and gage heights are the base data from which the other tables are computed. In cases of extensive development it is expected that engineers will use these original data in making their calculations, as the computations made by the Survey are based on the data available at the time they are made and should be reviewed and, if necessary, revised when additional data are available.

The rating table gives the discharge in second-feet corresponding to various stages of the river as given by the gage heights. It is published to enable engineers to determine the daily discharge in case this information is desired.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow for each second during the month. Upon this the computations for the remaining columns, which are defined on page 10, are based.

The values in the table of monthly discharge are intended to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates.

In most work where data in regard to flow are used the regimen of flow is of primary importance. Therefore for the principal stations tables have been prepared showing the horsepower that can be developed at various rates of flow, and the length of time that these rates of flow and the corresponding horsepower are available. These tables have been prepared on a basis of 80 per cent efficiency on the turbines, and the horsepower per foot of fall is given in order that the reader can determine the horsepower for any fall.

In the computations sufficient significant figures have been used so that the percentage of error in the tables will not in general exceed 1 per cent. Therefore, most of the values in the tables are given to only three significant figures. In making the various computations Thatcher's slide rule, Crelle's tables, and computation machines have been generally used.

In order to give engineers an idea of the relative value of the various data notes in regard to accuracy are given as far as possible. This accuracy depends on the general local conditions at the gaging stations and the amount of data collected. Every effort possible is made to so locate the stations that the data collected will give a high degree of accuracy. This is not always possible, but it is considered better to publish rough values with explanatory notes rather than no data.

In the accuracy notes the following terms have been used, indicating the probable accuracy, in per cent, of the mean monthly flow. As these values are mean values, the error in the value for the flow of any individual day may be much larger.

Excellent indicates that the mean monthly flow is probably accurate to within 5 per cent; good, to within 10 per cent; fair, to within 15 per cent; approximate, to within 25 per cent.

CONVENIENT EQUIVALENTS.

Following is a table of convenient equivalents for use in hydraulic computations:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second-foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equal 18.7 United States gallons per second.
100 California miner's inches equal 96.0 Colorado miner's inches.
100 California miner's inches for one day equal 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches equal 104 California miner's inches.
100 Colorado miner's inches for one day equal 5.17 acre-feet.
100 United States gallons per minute equal 0.223 second-foot.
100 United States gallons per minute for one day equal 0.442 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 22.95 acre-feet.

1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5.280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
$1\frac{1}{3}$ horsepower equal about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel, realizing 80 per cent of theoretical power.

FIELD METHODS OF MEASURING STREAM FLOW.

The methods used in collecting these data and in preparing them for publication are given in detail in Water-Supply Papers No. 94 (Hydrographic Manual, U. S. Geol. Survey) and No. 95 (Accuracy of Stream Measurements). In order that those who use this report may readily become acquainted with the general methods employed, the following brief descriptions are given:

Streams may be divided, with respect to their physical conditions, into three classes: (1) Those with permanent beds; (2) those with beds which change only during extreme low or high water; and (3) those with constantly shifting beds. In determining the daily flow special methods are necessary for each class. The data on which the determinations are based and the methods of collecting them are, however, in general the same.

There are three distinct methods of determining the flow of open-channel streams: (1) By measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir; (3) by measurements of the velocity of the current and of the area of the cross section. The method chosen for any case depends on the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to the coefficients to be used in the Chezy formula, $v = c\sqrt{Rs}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The

results obtained by the slope method are in general only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value for n to be used in Kutter's formula. The most common use of this method is in estimating the flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions.

Weir method.—When funds are available and the conditions are such that sharp-crested weirs can be erected, these offer the best facilities for determining flow. If dams are suitably situated and constructed, they may be utilized for obtaining reliable measurements of flow. The conditions necessary to insure good results may be divided into two classes: (1) Those relating to the physical characteristics of the dam itself, and (2) those relating to the diversion and use of water around and through the dam.

The physical requirements are as follows: (*a*) Sufficient height of dam, so that backwater will not interfere with free fall over it; (*b*) absence of leaks of appreciable magnitude; (*c*) topography or abutments which confine the flow over the dam at high stages; (*d*) level crests which are kept free from obstructions caused by floating logs or ice; (*e*) crests of a type for which the coefficients to be used in $Q = c\ b\ h^{\frac{3}{2}}$, or some similar standard weir formula, are known (see Water-Supply Papers Nos. 180 and 200[a]); (*f*) either no flashboards or exceptional care in reducing leakage through them and in recording their condition.

Preferably there should be no diversion of water through or around the dam. Generally, however, the dam is built for purposes of power or navigation, and part or all of the water flowing past it is diverted for such uses. This water is measured and added to that passing over the dam. To insure accuracy in such determinations of flow, the amount of water diverted should be reasonably constant. Furthermore, it should be so diverted that it can be measured, either by a weir, a current meter, or a simple system of water wheels which are of standard make, or which have been rated as meters under working conditions and so installed that the gate openings, the heads under which they work, and their angular velocities may be accurately observed.

The combination of physical conditions and uses of the water should be such that the determinations of flow will not involve, for a critical stage of considerable duration, the use of a head on a broad-crested dam of less than 6 inches. Moreover, when all other conditions are good, the cooperation of the owners or operators of the plant is still essential if reliable results are to be obtained.

[a] Water-Supply Paper No. 200 replaces No. 150, the edition of which has been exhausted.

A gaging station at a weir or dam has the general advantage of continuity of record through the period of ice and floods and the disadvantages of uncertainty of coefficient to be used in the weir formula and of complications in the diversion and use of the water.

Velocity method.—The determination of the quantity of water flowing past a certain section of a stream at a given time is termed a discharge measurement. This quantity is the product of two factors—the mean velocity and the area of the cross section. The mean velocity is a function of surface slope, wetted perimeter, roughness of bed, and the channel conditions at, above, and below the gaging section. The area depends on the contour of the bed and the fluctuations of the water surface. The two principal ways of measuring the velocity of a stream are by floats and current meters.

Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements, in order that the data may have the required degree of accuracy. Their essential requirements are practically the same, whether the velocity is determined by meters or floats. They are located, as far as possible, where the channel is straight both above and below the gaging section; where there are no cross currents, backwater, or boils; where the bed of the stream is reasonably free from large projections of a permanent character, and where the banks are high and subject to overflow only at flood stages. The station must be so far removed from the effects of tributary streams and of dams or other artificial obstructions that the gage height shall be an index of the discharge.

Certain permanent or semipermanent structures, usually referred to as "equipment," are generally pertinent to a gaging station. These are a gage for determining the fluctuations of the water surface, bench marks to which the datum of the gage is referred, permanent marks on a bridge or a tagged line indicating the points of measurement, and, where the current is swift, some appliance (generally a secondary cable) to hold the meter in position in the water. As a rule the stations are located at bridges if the channel conditions are satisfactory, as from them the observations can more readily be made and the cost of the equipment is small.

The floats in common use are the surface, subsurface, and tube or rod floats. A corked bottle with a flag in the top and weighted at the bottom makes one of the most satisfactory surface floats, as it is affected but little by wind. In case of flood measurements good results can be obtained by observing the velocity of floating cakes of ice or débris. In case of all surface-float measurements coefficients must be used to reduce the observed velocity to the mean velocity. The subsurface and tube or rod floats are intended to give directly the mean velocity in the vertical. Tubes give excellent results when the channel conditions are good, as in canals.

In measuring velocity by a float, observation is made of the time taken by the float to pass over the "run," a selected stretch of river from 50 to 200 feet long. In each discharge measurement a large number of velocity determinations are made at different points across the stream, and from these observations the mean velocity for the whole section is determined. This may be done by plotting the mean positions of the floats, as indicated by the distances from the bank, as ordinates and the corresponding times as abscissas. A curve through these points shows the mean time of run at any point across the stream, and the mean time for the whole stream is obtained by dividing the area bounded by this curve and its axis by the width. The length of the run divided by the mean time gives the mean velocity.

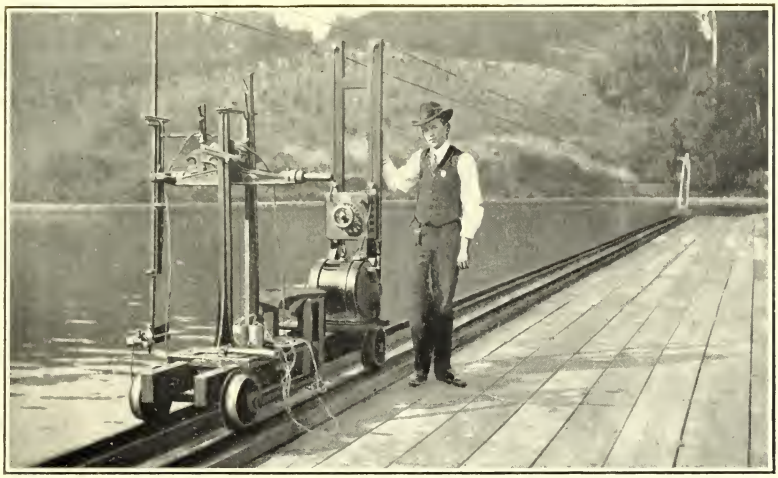
The area used in float measurements is the mean of the areas at the two ends of the run and at several intermediate sections.

The essential parts of the current meters in use are a wheel of some type, so constructed that the impact of flowing water causes it to revolve, and a device for recording or indicating the number of revolutions. The relation between the velocity of the moving water and the revolutions of the wheel is determined for each meter. This rating is done by drawing the meter through still water for a given distance at different speeds and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity per second for any number of revolutions.

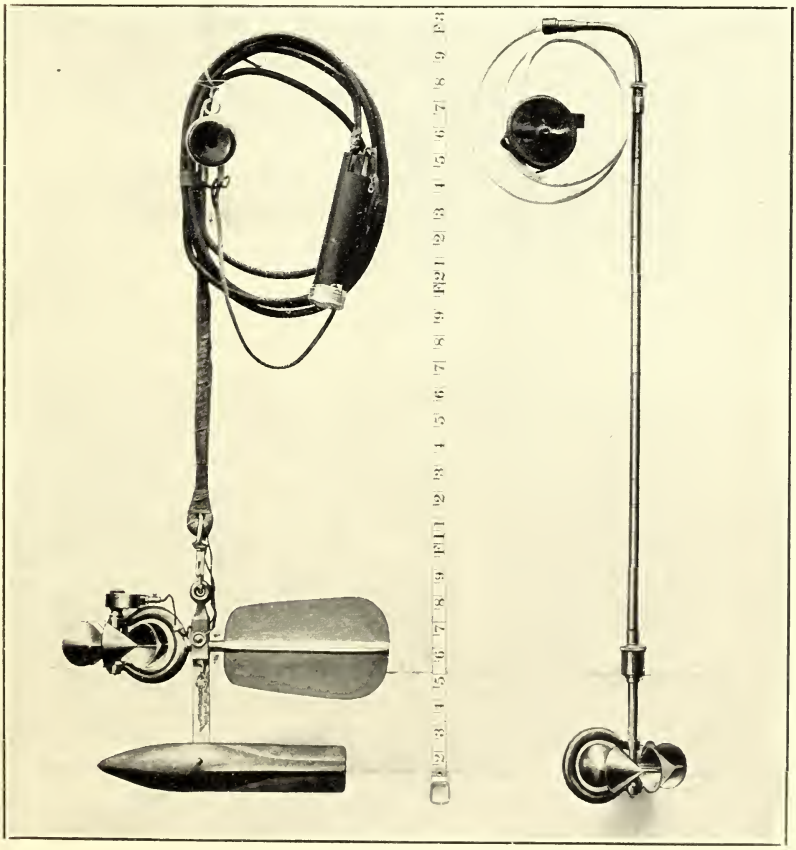
Many kinds of current meters have been constructed. They may, however, be classed in two general types—those in which the wheel is made up of a series of cups, as the Price, and those having a screw-propeller wheel, as the Haskell. Each meter has been developed for use under some special condition. In the case of the small Price meter, shown in Pl. II, *B*, which has been largely developed and extensively used by the United States Geological Survey, an attempt has been made to get an instrument which could be used under practically all conditions.

Current-meter measurements may be made from a bridge, cable, boat, or by wading, and gaging stations may be classified in accordance with such use. Fig. 1 shows a typical cable station.

In making the measurement an arbitrary number of points are laid off on a line perpendicular to the thread of the stream. The points at which the velocity and depth are observed are known as measuring points, and are usually fixed at regular intervals, varying from 2 to 20 feet, depending on the size and condition of the stream. Perpendiculars dropped from the measuring points divide the gaging section into strips. For each strip or pair of strips the mean velocity, area, and discharge are determined independently, so that conditions existing



A. CURRENT-METER RATING STATION AT LOS ANGELES, CAL.



B. PRICE CURRENT METERS.

in one part of the stream may not be extended to parts where they do not apply.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

The three principal multiple-point methods in general use are the vertical velocity-curve; 0.2 and 0.8 depth; and top, bottom, and mid-depth.

In the vertical velocity-curve method a series of velocity determinations are made in each vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve among the resulting points, the vertical velocity-curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity-curve and its axis by the depth. On account of the length of time required to

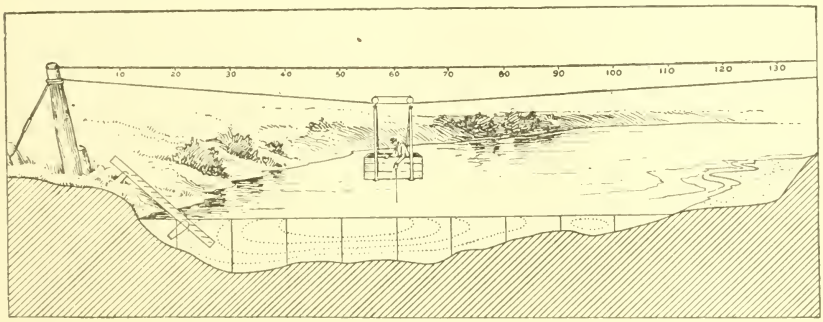


FIG. 1.—Cable station, showing section of river, car, gage, etc.

make a complete measurement by this method, its use is limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 of the depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity-curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 of the depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this second multiple-point method gives the mean velocity very closely for open-water conditions, and moreover the indications are that it holds nearly as well for ice-covered rivers.

In the third multiple-point method the meter is held at mid-depth, at 0.5 foot below the surface, and at 0.5 foot above the bottom, and the mean velocity is determined by dividing by 6 the sum of the top

velocity, four times the mid-depth velocity, and the bottom velocity. This method may be modified by observing at 0.2, 0.6, and 0.8 depth.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity, or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined.

Extensive experiments by vertical velocity-curves show that the thread of mean velocity generally occurs at from 0.5 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, at which point the meter is held in a majority of the measurements. A large number of vertical velocity-curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be from 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is specially adapted for flood measurements, or when the velocity is so great that the meter can not be kept at 0.6 depth.

The vertical-integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface, and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods.

The area, which is the other factor in the velocity method of determining the discharge of a stream, depends on the stage of the river, which is observed on the gage, and on the general contour of the bed of the stream, which is determined by soundings. The soundings are usually taken at each measuring point at the time of the discharge measurement, either by using the meter and cable or by a special sounding line or rod. For streams with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also of value in obtaining the area for use in computations of high-water measurements, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at various points of measurement, the measuring section is divided into elementary strips, as shown in fig. 1, and the mean velocity, area, and discharge are determined separately for either

a single or a double strip. The total discharge and the area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8 and vertical velocity-curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, the thickness and character of the ice, etc.

From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice. For information in regard to flow under ice cover see Water-Supply Paper No. 187.

OFFICE METHODS OF COMPUTING RUN-OFF.

There are two principal methods of determining run-off, depending on whether or not the bed of the stream is permanent.

For stations on streams with permanent beds the first step in computing the run-off is the construction of a rating table, which shows the discharge corresponding to any stage of the stream. This rating table is applied to the record of stage to determine the amount of water flowing. The construction of the rating table depends on the method used in measuring flow.

For a station at a weir or dam the basis for the rating table is some standard weir formula. The coefficients to be used in its application depend on the type of dam and other conditions near its crest. After inserting in the weir formula the measured length of crest and the assumed coefficient the discharge is computed for various heads and the rating table constructed.

The data necessary for the construction of a rating table for a velocity-area station are the results of the discharge measurements, which include the record of stage of the river at the time of measurement, the area of the cross section, the mean velocity of the current, and the quantity of water flowing. A thorough knowledge of the conditions at and in the vicinity of the station is also necessary.

The construction of the rating table depends on the following laws of flow for open, permanent channels: (1) The discharge will remain constant so long as conditions at or near the gaging station remain constant; (2) the discharge will be the same whenever the stream is at a given stage if the change of slope due to the rise and fall of the stream be neglected; (3) the discharge is a function of and increases gradually with the stage.

The plotting of results of the various discharge measurements, using gage heights as ordinates and discharge, mean velocity, and area as abscissas, will define curves which show the discharge, mean velocity, and area corresponding to any gage height. For the development of these curves there should be, therefore, a sufficient number of discharge measurements to cover the range of the stage of the stream. Fig. 2 shows a typical rating curve with its corresponding mean-velocity and area curves.

As the discharge is the product of two factors, the area and the mean velocity, any change in either factor will produce a corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate soundings extending to the limits of high water. It is always concave toward the horizontal axis or on a straight line, unless the banks of the stream are overhanging.

The form of the mean-velocity curve depends chiefly on the surface slope, the roughness of the bed, and the cross section of the stream. Of these, the slope is the principal factor. In accordance with the relative changes of these factors the curve may be either a straight line, convex or concave toward either axis, or a combination of the three. From a careful study of the conditions at any gaging station the form which the vertical velocity-curve will take can be predicted, and it may be extended with reasonable certainty to stages beyond the limits of actual measurements. Its principal use is in connection with the area curve in locating errors in discharge measurements and in constructing the rating table.

The discharge curve is defined primarily by the measurements of discharge, which are studied and weighted in accordance with the local conditions existing at the time of each measurement. The curve may, however, best be located between and beyond the measurements by means of curves of area and mean velocity. The discharge curve under normal conditions is concave toward the horizontal axis and is generally parabolic in form.

In the preparation of the rating table the discharge for each tenth or half tenth on the gage is taken from the curve. The differences between successive discharges are then taken and adjusted according to the law that they shall either be constant or increasing.

The determination of daily discharge of streams with changeable beds is a difficult problem. In case there is a weir or dam available, a condition which seldom exists on streams of this class, the discharge can be determined by its use. In case of velocity-area stations frequent discharge measurements must be made if the determinations of flow are to be other than rough approximations. For stations with beds which shift slowly or are materially changed only during floods

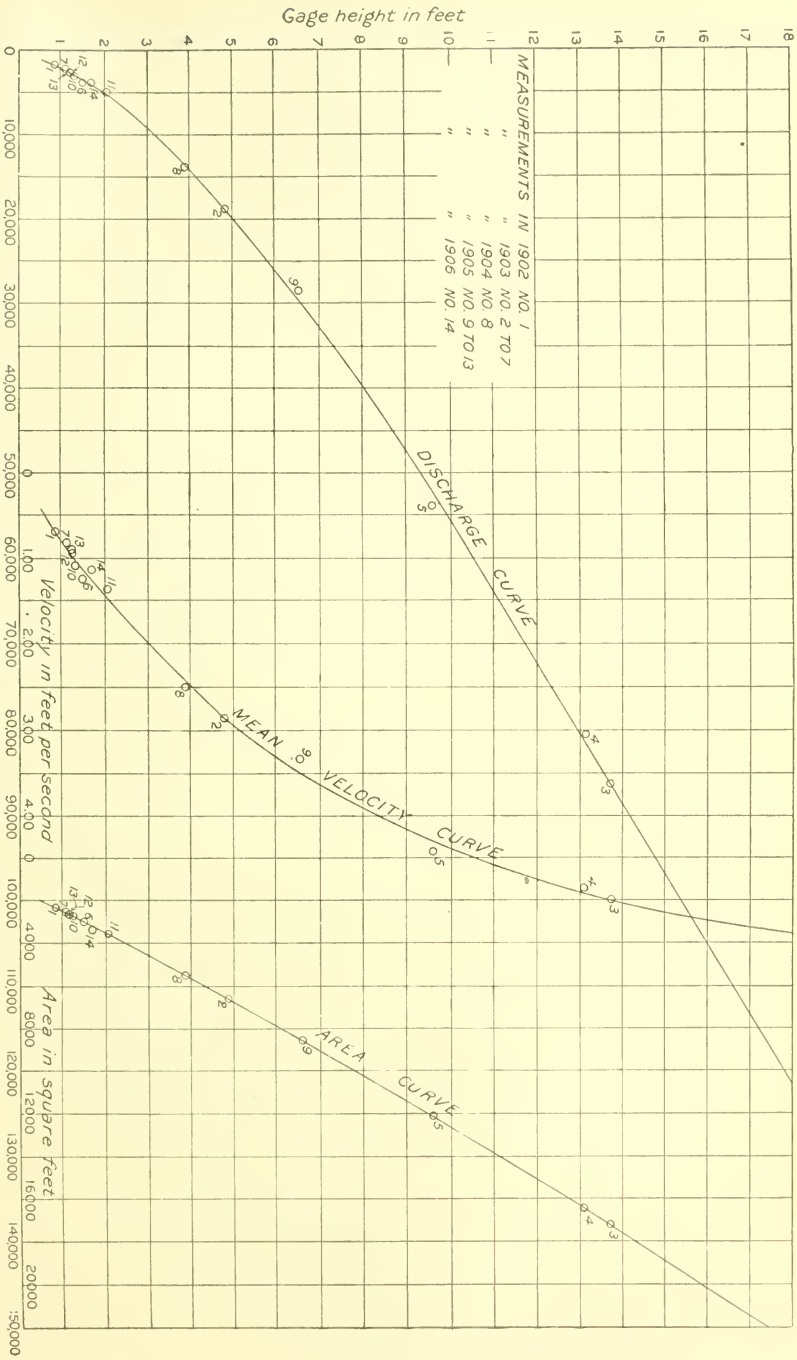


FIG. 2.—Discharge, area, and mean-velocity curves for Potomac River at Point of Rocks, Md.

rating tables can be prepared for periods between such changes and satisfactory results obtained with a limited number of measurements, provided that some of them are taken soon after the change occurs. For streams with continually shifting beds, such as the Colorado and Rio Grande, discharge measurements should be made every two or three days and the discharges for intervening days obtained either by interpolation modified by gage height or by Professor Stout's method, which has been described in full in the Nineteenth Annual Report of the United States Geological Survey, Part IV, page 323, and in the Engineering News of April 21, 1904. This method, or a graphical application of it, is also much used in determining the flow at stations where the bed shifts but slowly.

COOPERATION AND ACKNOWLEDGMENTS.

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WESTERN GULF OF MEXICO DRAINAGE.

SABINE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Sabine River has its headwaters in Collin and Hunt counties, Tex., flows in a southeasterly direction to the State line, then south, forming the boundary between Texas and Louisiana, and empties into Sabine Lake, an arm of the Gulf, near Orange, Tex. The small tributaries in eastern Texas support many small water mills, and the Sabine itself is navigable for several hundred miles. The drainage area of the Sabine in Texas above Orange is 7,500 square miles and its total drainage area above Orange in Louisiana and Texas is 10,400 square miles.

SABINE RIVER NEAR LONGVIEW, TEX.

This station was established January 1, 1904, at the bridge of the International and Great Northern Railroad, about 3 miles southwest of Longview Junction, Tex. During 1906 the gage was read by P. H. Gray. The conditions at the station and the bench marks

are described in Water-Supply Paper No. 174, page 13, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of Sabine River near Longview, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	31.3	23.4	23.3	26.4	17.9	19.9	7.9	11.1	10.0	10.9	7.1	12.2
2	30.8	24.0	21.7	26.4	15.4	13.2	8.6	11.1	8.5	10.5	6.9	12.7
3	30.3	24.3	20.7	26.4	13.6	14.1	8.6	11.1	8.0	10.2	6.3	12.9
4	29.7	24.2	19.9	26.8	12.4	15.8	8.8	10.8	7.2	9.9	6.9	12.4
5	28.6	23.2	19.0	27.2	12.5	14.1	8.3	10.8	7.3	9.7	7.0	11.4
6	27.1	21.0	16.8	27.5	13.8	13.0	7.7	11.2	8.2	9.4	7.2	10.2
7	25.4	17.6	14.0	27.8	14.7	14.1	7.2	10.9	8.5	9.0	6.8	9.7
8	23.8	14.1	13.4	27.8	15.8	15.6	7.0	10.5	9.5	8.1	6.9	9.0
9	22.6	12.3	13.9	27.5	16.4	17.3	6.9	9.8	9.8	8.1	7.1	8.7
10	22.6	11.7	14.1	26.4	17.1	19.0	6.9	9.1	10.0	8.3	6.9	8.4
11	21.0	11.3	13.9	25.7	16.2	20.4	7.2	8.6	11.2	7.3	6.6	8.2
12	20.6	11.1	13.9	24.2	16.2	20.7	7.3	7.0	10.4	7.2	7.1	8.1
13	20.2	13.2	14.6	22.8	16.3	21.4	7.3	7.4	10.6	6.5	7.1	8.1
14	19.7	17.8	15.4	22.3	14.2	21.0	7.3	7.7	10.1	8.9	7.1	8.4
15	19.0	19.8	16.0	21.2	13.2	19.7	7.1	8.5	9.7	9.5	7.0	8.7
16	17.0	20.0	16.2	20.3	13.0	13.9	7.1	8.4	9.5	9.8	7.0	15.9
17	15.0	20.2	14.9	19.4	13.0	9.4	7.4	9.0	10.6	10.5	6.9	22.0
18	13.6	21.0	12.8	16.9	12.9	8.5	9.6	9.6	10.2	12.4	6.9	23.0
19	13.0	22.1	11.8	13.9	12.8	8.2	10.6	11.7	10.0	14.3	7.0	23.8
20	12.7	23.4	11.8	12.4	12.2	8.0	10.2	12.0	9.8	15.3	7.1	23.4
21	12.5	24.6	11.4	13.4	13.4	7.7	9.7	11.9	9.7	16.8	7.3	24.6
22	14.2	25.7	11.2	14.7	15.7	7.9	8.9	11.3	8.5	17.0	7.6	25.9
23	15.1	27.5	11.1	14.5	17.7	8.3	10.4	10.4	8.4	16.1	7.9	26.0
24	15.5	27.0	11.4	13.9	19.7	8.2	11.5	10.0	7.2	13.4	8.3	27.2
25	16.2	27.3	11.5	13.4	20.9	7.9	10.8	9.8	7.0	13.0	7.6	30.0
26	17.2	27.3	11.4	13.6	23.0	8.0	9.9	10.2	7.0	10.8	8.1	30.7
27	18.2	26.5	15.4	14.9	24.2	8.3	9.1	10.5	7.0	9.3	8.7	30.7
28	19.2	24.9	21.7	15.9	24.7	7.8	8.5	11.1	6.9	8.3	9.7	30.4
29	20.4	.....	26.5	16.6	25.0	7.8	15.0	11.5	6.3	7.8	10.6	29.8
30	21.4	.....	27.0	17.1	24.4	7.5	16.5	11.9	6.2	7.6	11.2	28.8
31	22.6	.....	27.0	.....	22.4	.....	13.7	10.1	.....	7.4	.....	27.4

Rating table for Sabine River near Longview, Tex., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
6.30	74	7.60	251	8.90	483	11.40	1,001	22.00	4,230
6.40	85	7.70	267	9.00	502	11.60	1,045	23.00	4,776
6.50	97	7.80	283	9.20	540	11.80	1,090	24.00	5,400
6.60	109	7.90	300	9.40	580	12.00	1,136	25.00	6,112
6.70	122	8.00	317	9.60	620	13.00	1,366	26.00	6,900
6.80	135	8.10	335	9.80	660	14.00	1,605	27.00	7,746
6.90	148	8.20	353	10.00	700	15.00	1,850	28.00	8,700
7.00	162	8.30	371	10.20	742	16.00	2,103	29.00	9,860
7.10	176	8.40	389	10.40	784	17.00	2,366	30.00	11,200
7.20	190	8.50	407	10.60	826	18.00	2,640	31.00	12,670
7.30	205	8.60	426	10.80	869	19.00	2,938	32.00	14,300
7.40	220	8.70	445	11.00	913	20.00	3,310		
7.50	235	8.80	464	11.20	957	21.00	3,746		

NOTE.—The above table is based on 26 discharge measurements made during 1904–5 and is well defined below gage height 22.0 feet.

Monthly discharge of Sabine River near Longview, Tex., for 1906.

[Drainage area, 2,900 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	13,200	1,250	4,520	278,000	1.56	1.80
February	8,200	935	4,400	244,000	1.52	1.58
March	7,750	935	2,540	156,000	0.876	1.01
April	8,490	1,230	4,420	263,000	1.52	1.70
May	6,110	1,180	2,580	159,000	0.890	1.03
June	3,940	235	1,490	88,700	0.514	.57
July	2,230	148	564	34,700	0.194	.22
August	1,140	162	747	45,900	0.258	.30
September	957	63	480	28,600	0.166	.19
October	2,370	97	837	51,500	0.289	.33
November	957	74	256	15,200	0.088	.10
December	12,200	335	4,370	269,000	1.51	1.74
The year	13,200	74	2,270	1,630,000	.782	10.57

SABINE RIVER AT LOGANSPORT, LA.

This station was established December 27, 1905, at the bridge of the Houston, East and West Texas Railway. The drainage area above this point is practically all in Texas.

The channel is straight for 400 feet above and 4,000 feet below the station. The current is sluggish at low stages. The right bank is low, wooded, and liable to overflow; the left is high, and does not overflow. The flood plain is not very wide, and the conditions are favorable for accurate measurements. There is but one channel at low stages, but at high water the piers of the bridge divide the stream into several channels. The highest flood on record (gage height 41.2 feet) occurred in 1884.

Discharge measurements are made from the railroad bridge. The initial points for soundings are the face of the west abutment and the east face of each pier. The section under each span of the bridge is treated as a distinct channel.

The gage is marked off on the downstream side of a pier of the highway bridge, which is 200 feet above the railroad bridge. It is near the west bank. A boxed chain gage which is attached to the upstream railing of the highway bridge is also used. Gage heights for 1903 to 1905 were furnished by the United States Weather Bureau. The datum of the Weather Bureau gage is 2.00 feet above that of the Geological Survey, and the gage heights have been reduced to the latter datum. The bench mark is a railroad spike driven into the north side of a tree 150 feet from the low-water edge on the east bank between the railroad and highway bridges; elevation, 50.54 feet. The reference point is the top of the tie at the foot of hip vertical of the Pratt truss, north side, east end; elevation, 52.90 feet. Elevations refer to the datum of the Geological Survey gage.

Discharge measurements of Sabine River at Logansport, La., for 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 20	T. U. Taylor	153	2,120	12.9	2,280
June 16	do			15.5	3,500
July 6	do	130	1,130	6.1	530
December 30	do			22.0	6,830

Daily gage height, in feet, of Sabine River at Logansport, La., for 1903–1906.

1903.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.0	7.0	6.4	3.0	6.3	5.6	17	18.8	5.1	3.7	12.0	6.3	6.1
2	7.4	9.5	6.0	3.0	6.2	5.6	18	18.8	5.1	3.6	11.7	6.1	5.7
3	8.5	11.5	5.7	3.0	6.1	5.4	19	18.8	5.4	3.5	11.2	6.0	5.2
4	9.9	13.5	5.4	3.0	6.0	5.4	20	18.9	5.6	3.4	10.5	6.0	5.1
5	11.3	14.4	5.0	3.5	5.8	5.3	21	19.0	6.8	3.3	9.5	6.0	5.0
6	13.6	14.9	4.5	5.5	5.6	5.3	22	19.3	8.0	3.3	8.8	6.0	5.0
7	15.4	15.1	4.2	6.6	5.4	5.2	23	19.5	10.0	3.3	8.5	6.0	5.0
8	16.0	13.4	4.2	7.6	5.2	5.2	24	19.9	12.0	3.3	8.2	5.9	5.0
9	16.0	11.4	4.0	8.5	5.2	5.2	25	19.9	12.0	3.2	7.6	5.8	5.6
10	16.2	10.0	4.0	10.0	5.5	5.1	26	18.5	11.6	3.1	7.0	5.7	6.0
11	16.5	8.2	4.0	10.6	6.0	5.0	27	14.9	10.2	3.1	7.0	5.7	6.0
12	17.0	6.8	3.9	11.0	7.0	5.4	28	10.4	9.2	3.0	6.9	5.7	6.0
13	17.2	6.0	3.8	11.3	7.4	5.8	29	7.7	8.0	3.0	6.8	5.6	6.0
14	17.7	5.7	3.7	11.5	7.6	6.2	30	6.5	7.5	3.0	6.6	5.6	6.0
15	18.1	5.4	3.7	11.7	7.2	6.3	31	6.0	6.8	.....	6.4	.....	6.0
16	18.6	5.1	3.7	11.8	6.8	6.4							

1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.0	8.3	8.5	12.5	11.4	5.0	7.0	7.0	2.4	3.2	2.1	3.0
2	5.9	8.0	8.0	13.0	10.0	5.0	7.2	6.6	2.4	3.2	2.1	3.0
3	5.8	7.6	7.4	13.2	8.2	5.0	8.0	6.2	2.2	3.0	2.2	3.0
4	5.7	7.0	7.0	13.4	8.0	5.0	8.4	5.6	2.2	2.8	2.6	3.0
5	5.6	6.5	6.6	13.0	9.0	4.6	9.6	5.0	2.4	2.8	2.6	3.0
6	5.5	6.0	6.4	12.9	9.2	4.2	10.2	4.8	2.6	2.8	2.6	3.0
7	5.5	5.5	6.2	12.2	10.2	4.0	10.2	6.6	2.4	2.8	2.6	3.0
8	5.4	5.2	6.0	14.5	10.0	4.6	10.4	6.4	2.4	2.8	2.6	3.0
9	5.3	5.0	5.9	18.8	10.2	5.6	10.2	5.6	2.4	2.7	2.6	2.8
10	5.2	5.4	5.7	20.0	11.0	7.0	9.6	5.4	2.6	2.7	2.6	2.8
11	5.1	5.5	5.4	20.2	12.0	10.2	9.2	4.6	2.8	2.7	2.6	2.8
12	5.0	5.5	5.2	20.4	12.8	12.4	8.2	4.6	3.0	2.8	2.6	2.8
13	4.9	5.4	5.0	20.6	13.4	14.2	7.6	4.8	3.6	2.8	2.6	2.8
14	4.8	5.3	5.0	19.8	13.8	15.4	7.0	4.6	4.4	2.8	2.6	2.8
15	4.7	5.1	5.0	19.2	14.0	16.3	6.6	4.4	4.8	2.8	2.6	2.8
16	4.6	5.0	5.0	18.4	14.2	16.2	6.0	5.2	4.8	2.7	2.6	2.8
17	4.5	5.0	5.0	17.6	14.3	15.8	5.4	5.4	4.6	2.7	2.6	2.8
18	4.4	5.0	5.0	17.8	14.6	15.4	5.0	5.2	4.4	2.7	2.7	2.6
19	4.4	5.4	5.2	17.6	14.8	15.4	4.6	5.0	4.2	2.8	2.6	2.6
20	4.4	5.6	5.5	17.8	15.0	15.6	4.2	4.8	4.0	2.8	2.8	2.6
21	4.4	6.5	5.8	18.2	15.2	15.8	4.0	4.4	4.0	2.8	3.0	2.6
22	4.5	8.8	6.0	18.6	15.4	16.0	3.8	4.0	4.4	2.8	2.9	2.6
23	4.6	10.2	8.8	18.8	15.2	15.6	4.0	3.8	4.6	2.7	2.9	2.6
24	4.9	11.0	11.0	19.4	13.4	13.8	6.0	3.4	4.5	2.7	2.9	2.8
25	5.3	12.2	11.3	19.6	10.6	11.4	6.6	3.4	4.4	2.7	2.9	3.0
26	6.0	11.6	11.0	19.8	8.4	10.0	7.0	3.2	4.3	2.8	3.0	4.0
27	6.8	11.2	11.0	20.0	6.6	8.6	7.6	3.2	4.2	2.4	3.3	22.0
28	7.0	10.2	11.4	20.2	6.2	7.4	8.0	2.8	3.8	2.3	3.3	27.0
29	7.4	9.3	12.0	19.6	5.6	7.0	8.2	2.8	3.6	2.2	3.3	28.8
30	7.8	.....	12.3	16.2	5.2	6.8	8.0	2.6	3.4	2.1	3.4	28.6
31	8.5	.....	12.5	.....	5.0	.....	7.6	2.6	.....	2.1	.....	27.8

Daily gage height, in feet, of Sabine River at Logansport, La., for 1903–1906—Continued.

1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	26.0	18.0	22.0	23.0	28.0	33.2	21.0	28.6	5.6	4.2	8.8	9.0
2	24.6	15.0	20.5	22.8	27.8	33.6	22.4	27.7	5.8	4.0	9.0	9.2
3	22.0	13.5	18.0	23.6	27.4	33.5	23.2	26.6	6.2	4.0	9.3	11.5
4	17.8	12.0	16.4	25.0	27.0	32.8	24.0	25.7	6.4	4.1	9.5	12.0
5	13.0	10.0	15.3	25.2	26.8	32.0	24.0	24.8	6.4	4.3	9.2	13.0
6	10.4	9.0	14.6	24.8	26.4	31.5	24.8	24.0	6.2	4.7	9.6	12.8
7	10.2	10.5	12.0	25.0	26.2	30.6	25.0	23.0	5.8	4.9	11.8	12.2
8	8.6	13.0	9.8	25.0	26.6	29.8	24.8	22.8	5.4	4.8	13.6	11.8
9	8.4	17.5	15.0	24.8	26.4	29.0	25.3	22.2	5.4	4.9	13.5	11.0
10	7.8	20.0	21.0	24.5	26.2	28.5	25.7	22.0	5.4	5.0	19.2	10.8
11	8.0	21.5	25.8	24.0	26.8	27.8	26.0	21.5	5.0	4.8	20.2	11.0
12	9.2	22.4	28.5	24.0	27.6	27.0	26.2	20.2	5.0	4.8	20.6	11.0
13	11.0	23.0	28.8	23.8	29.0	26.6	26.6	17.6	5.0	4.7	20.2	10.6
14	12.6	22.5	28.0	22.8	30.0	25.7	26.0	13.8	4.6	4.6	19.8	13.8
15	13.2	22.0	26.8	23.6	30.8	24.0	26.2	11.0	4.5	4.6	18.9	17.7
16	13.0	21.5	25.0	24.0	31.6	24.0	26.4	11.0	4.5	4.3	18.0	20.0
17	13.2	18.8	23.5	23.8	32.0	22.2	27.4	8.6	4.4	4.4	17.3	21.0
18	12.6	16.5	21.8	24.0	32.8	17.6	28.0	7.7	4.4	4.4	15.5	21.5
19	10.8	18.2	21.0	25.0	32.9	13.0	31.3	7.2	4.8	4.5	14.0	22.6
20	11.2	23.0	21.2	25.6	32.8	10.5	31.0	7.0	6.0	4.3	13.8	23.8
21	12.4	25.5	21.6	26.0	32.5	10.0	30.0	7.1	6.0	4.2	12.6	25.0
22	12.4	25.5	22.0	26.9	32.7	10.4	30.2	7.3	5.8	4.0	12.4	25.8
23	12.2	26.5	21.8	26.6	33.6	10.8	30.0	7.8	6.2	4.0	12.2	27.0
24	12.0	26.8	23.6	26.9	34.8	13.0	30.4	7.5	6.2	4.1	13.9	27.8
25	11.2	26.4	24.0	27.5	35.7	15.3	30.7	6.0	5.8	6.6	14.4	28.0
26	9.8	26.8	24.5	27.8	35.8	17.5	30.6	6 2	5.6	10.0	14.0	28.3
27	8.8	25.0	23.8	27.6	35.4	18.5	32.3	5.8	5.3	12.1	13.5	28.2
28	8.6	23.5	23.5	27.5	34.6	19.0	32.0	5.4	4.8	11.8	12.0	28.0
29	12.0	.....	23.0	27.5	34.0	19.7	31.3	5.4	4.6	11.3	11.0	27.8
30	13.2	.....	24.4	28.0	33.2	20.2	30.6	5.0	4.3	9.8	10.0	26.9
31	15.4	.....	24.0	.....	33.0	.....	29.7	5.2	.....	9.0	.....	27.2

1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	28.0	21.8	20.4	29.2	12.8	18.0	9.0	19.0	7.8	4.8	6.4	7.2
2	29.5	20.6	20.8	29.7	13.3	18.6	8.6	19.8	8.0	5.1	5.8	8.0
3	30.7	19.7	21.0	29.0	13.7	21.4	8.4	20.3	8.0	5.3	5.5	8.6
4	31.2	19.0	21.0	28.6	13.8	22.6	8.2	19.8	7.8	5.0	5.2	9.0
5	31.6	19.2	21.2	28.0	14.0	22.4	7.0	17.4	7.8	4.8	4.8	9.4
6	31.2	19.6	21.0	27.0	14.0	22.8	6.8	15.0	8.0	4.5	4.8	9.4
7	31.0	19.8	20.7	26.6	15.8	22.6	6.8	15.8	8.0	4.5	4.7	9.3
8	30.8	20.0	19.0	25.8	16.0	21.7	6.6	17.0	8.0	4.5	4.6	9.2
9	30.5	20.2	18.2	25.0	16.6	20.0	6.6	11.6	7.6	4.5	4.6	8.8
10	30.0	20 0	17.0	24.6	17.0	18.0	6.4	10.4	7.4	4.3	4.6	8.2
11	29.2	19.3	15.5	24.0	16.6	16.6	6.2	9.0	7.6	4.2	4.5	8.0
12	28.5	18.5	13.0	23.7	16.0	15.6	6.6	8.3	7.8	4.1	4.5	7.4
13	26.7	15.4	12.8	23.8	15.4	14.0	7.0	7.0	7.8	4.1	4.4	7.0
14	26.0	17.0	12.5	24.0	14.2	15.2	7.2	7.0	8.7	4.3	4.3	6.7
15	25.0	17.2	12.7	23.8	13.6	15.0	7.0	6.6	9.0	6.8	4.3	6.5
16	24.0	17.8	12.7	23.5	13.8	15.6	7.0	6.4	8.8	11.0	4.3	8.3
17	22.4	18.5	12.9	23.6	14.0	15.8	7.2	6.2	8.5	13.2	4.2	14.7
18	22.0	18.8	13.5	23.0	15.8	16.0	8.0	6.6	8.6	13.4	5.1	19.4
19	21.5	19.0	13.8	22.7	17.0	13.6	8.3	6.8	8.6	13.2	6.0	21.0
20	20.0	19.5	13.6	22.0	17.2	11.0	8.0	7.2	8.3	13.1	6.0	22.7
21	18.2	19.0	13.0	21.2	16.6	10.2	8.2	8.4	8.3	13.0	6.1	23.6
22	20.6	19.0	11.8	19.0	14.8	9.4	7.8	9.0	8.2	12.7	6.4	24.4
23	23.8	18.8	10.2	17.2	14.0	8.2	8.0	9.2	7.8	12.8	6.2	24.6
24	29.0	18.6	10.0	14.0	14.2	8.0	8.0	9.0	7.5	13.0	6.0	24.0
25	30.2	19.2	9.8	13.3	14.8	8.3	8.4	8.8	8.2	12.9	5.8	23.7
26	29.8	19.6	9.6	13.9	16.0	8.6	8.8	8.5	8.5	12.6	5.8	22.1
27	29.0	20.0	10.0	14.0	16.0	9.6	9.0	8.2	7.7	12.4	6.0	22.2
28	27.6	20.2	18.2	13.0	17.0	11.8	8.7	8.0	6.3	11.1	5.6	21.8
29	26.0	.....	23.6	12.8	17.0	10 2	10.0	8.0	5.1	10.2	5.9	21.0
30	24.5	.....	25.7	12.6	17.6	9.4	15.0	7.6	4.9	8.7	6.5	22.0
31	23.0	.....	28.0	.....	18.0	.....	18.0	7.6	.....	7.4	.....	22.3

Rating table for Sabine River at Logansport, La., for 1903–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.10	105	3.60	208	5.20	388	9.00	1,145	24.00	8,070
2.20	110	3.70	217	5.40	418	10.00	1,420	25.00	8,720
2.30	115	3.80	226	5.60	449	11.00	1,720	26.00	9,380
2.40	121	3.00	235	5.80	481	12.00	2,040	27.00	10,050
2.50	127	4.10	245	6.00	515	13.00	2,390	28.00	10,730
2.60	133	4.10	255	6.20	551	14.00	2,770	29.00	11,420
2.70	139	4.20	265	6.40	587	15.00	3,180	30.00	12,120
2.80	146	4.30	276	6.60	624	16.80	3,620	31.00	12,830
2.90	153	4.40	287	6.80	662	17.00	4,090	32.00	13,550
3.00	160	4.50	298	7.00	700	18.00	4,590	33.00	14,270
3.10	167	4.60	310	7.20	740	19.00	5,120	34.00	15,000
3.20	175	4.70	322	7.40	780	20.00	5,670	35.00	15,740
3.30	183	4.80	334	7.60	821	21.00	6,240	36.00	16,490
3.40	191	4.90	347	7.80	863	22.00	6,830		
3.50	199	5.00	360	8.00	905	23.00	7,440		

NOTE.—The above table is based on four discharge measurements made during 1906. Discharges for 1906 computed from this table may be considered reasonably close above gage height 6.0 feet. All discharges below 6.0 feet are provisional and subject to revision. It has been assumed that conditions of flow remained constant from July 1, 1903, to date, but this may not be true.

Monthly discharge of Sabine River at Logansport, La., for 1903–1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
July	5,610	515	3,460	213,000
August	3,220	374	1,310	80,600
September	587	160	252	15,000
October	2,040	160	1,050	64,600
November	821	388	530	31,500
December	587	360	445	27,400
The period				432,000
1904.				
January	1,020	287	448	27,500
February	2,110	360	811	46,600
March	2,210	360	894	55,000
April	6,010	2,110	4,420	263,000
May	3,350	360	1,880	116,000
June	3,760	245	1,810	108,000
July	1,540	226	808	49,700
August	700	133	341	21,000
September	334	110	213	12,700
October	175	105	141	8,670
November	191	105	142	8,450
December	11,300	133	1,730	106,000
The year	11,300	105	1,140	823,000
1905.				
January	9,380	863	2,520	155,000
February	9,920	1,140	5,900	328,000
March	11,300	1,360	6,850	421,000
April	10,700	7,320	8,880	528,000
May	16,300	9,510	12,600	775,000
June	14,700	1,420	7,950	473,000
July	13,800	6,240	10,400	640,000
August	11,100	360	3,810	234,000
September	587	276	423	25,200
October	2,070	245	562	34,600
November	6,010	1,090	2,940	175,000
December	10,900	1,140	5,700	350,000
The year	16,300	245	5,710	4,140,000
1906.				
January	13,300	4,690	10,000	615,000
February	6,710	3,350	5,200	289,000
March	10,700	1,310	4,060	250,000
April	11,900	2,250	7,110	423,000
May	4,590	2,320	3,370	207,000
June	7,320	905	3,520	209,000
July	4,590	551	1,050	64,600
August	5,840	551	1,900	117,000
September	1,140	347	877	52,200
October	2,540	255	1,220	75,000
November	605	265	413	24,600
December	8,460	605	3,820	235,000
The year	13,300	255	3,540	2,560,000

NECHES RIVER AT EVADALE, TEX.

A gaging station was established on Neches River at Evadale July 1, 1904. It is located at the bridge of the Gulf, Beaumont and Kansas City Railway. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 15, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of Neches River, at Evadale, Tex, for 1906

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	19.3	19.2	17.4	18.2	15.6	12.4	12.0	15.2	8.7	8.2	12.5	9.4
2	19.5	19.7	17.4	18.6	15.8	12.3	11.7	15.9	8.5	8.2	12.2	9.3
3	19.6	19.9	17.3	18.6	16.4	12.3	11.3	16.2	8.3	8.4	11.7	9.2
4	19.7	19.8	17.1	18.3	16.7	12.8	10.9	16.4	8.1	8.7	11.3	9.2
5	19.9	19.6	17.0	17.8	17.0	13.2	10.9	16.1	7.9	10.0	11.1	9.2
6	20.2	19.5	16.9	17.5	17.3	13.4	10.6	16.0	7.7	10.9	11.1	9.3
7	20.4	19.4	16.9	16.9	17.5	13.5	10.2	15.9	7.6	11.7	10.7	9.5
8	20.5	19.3	16.8	16.7	17.4	13.4	10.0	15.7	7.5	12.3	10.3	9.7
9	20.6	19.2	16.7	16.6	17.2	13.3	10.2	15.5	7.8	11.0	10.1	9.8
10	20.7	18.0	16.6	16.4	17.1	13.5	10.4	15.1	8.2	10.5	10.0	10.3
11	20.9	17.8	16.5	16.4	17.2	13.7	10.5	14.7	8.5	9.8	9.7	11.5
12	21.0	17.5	16.4	16.5	17.4	14.0	10.6	14.5	9.3	9.2	9.2	12.3
13	21.1	17.3	16.3	16.8	17.1	14.2	10.7	14.5	9.9	10.9	8.9	13.2
14	21.1	17.1	16.3	16.9	16.7	14.5	11.5	14.5	9.9	12.7	8.7	13.5
15	21.0	17.5	16.3	17.2	16.4	14.7	11.5	14.4	9.7	14.7	8.5	12.5
16	20.9	18.0	16.2	17.6	15.9	14.7	10.5	13.6	9.3	16.5	8.3	13.3
17	20.8	18.3	16.1	17.3	15.1	14.5	10.2	13.3	9.0	17.9	8.2	14.1
18	20.7	18.2	15.6	18.7	15.6	14.2	10.7	13.1	8.6	19.7	8.0	14.6
19	20.5	18.1	15.9	18.4	14.0	13.8	11.2	12.5	8.3	19.9	8.2	15.5
20	20.1	18.0	16.6	17.9	13.6	13.5	12.9	11.9	8.1	20.0	8.4	16.2
21	19.8	17.9	17.8	17.3	13.3	13.1	13.5	11.3	7.9	19.7	8.6	17.5
22	19.5	17.7	17.7	17.0	13.1	12.8	14.5	11.0	7.6	19.2	8.9	17.0
23	19.2	17.6	17.7	16.5	13.1	12.4	15.2	10.5	7.4	18.1	9.3	16.1
24	18.9	17.5	17.8	16.1	13.1	11.3	14.9	9.9	8.0	15.8	9.5	16.0
25	18.7	17.5	17.1	15.9	13.0	10.2	14.3	9.6	8.4	14.7	9.7	15.6
26	18.9	17.5	16.2	15.6	12.9	9.9	13.9	9.5	8.9	14.3	10.0	15.2
27	19.1	17.5	14.8	15.4	12.8	10.9	13.8	9.4	9.5	14.0	10.0	15.1
28	19.1	17.4	14.2	15.4	12.7	11.7	13.3	9.3	9.1	13.7	9.8	15.0
29	19.1	.....	15.9	15.3	12.7	12.2	12.9	9.2	8.7	13.5	9.6	15.1
30	19.1	.....	17.2	15.4	12.6	12.3	13.7	9.0	8.2	13.2	9.5	15.2
31	19.2	.....	17.8	.....	12.5	.....	14.5	8.8	.....	12.8	.....	15.2

Rating table for Neches River at Evadale, Tex., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
7.40	560	8.50	787	9.60	1,047	11.40	1,578	16.00	4,350
7.50	580	8.60	809	9.70	1,072	11.60	1,650	17.00	5,410
7.60	600	8.70	831	9.80	1,098	11.80	1,724	18.00	6,660
7.70	620	8.80	854	9.90	1,124	12.00	1,800	19.00	8,270
7.80	640	8.90	877	10.00	1,150	12.20	1,880	20.00	10,100
7.90	660	9.00	900	10.20	1,204	12.40	1,966	21.00	12,090
8.00	680	9.10	924	10.40	1,260	12.60	2,056	22.00	14,300
8.10	701	9.20	948	10.60	1,318	12.80	2,150		
8.20	722	9.30	972	10.80	1,378	13.00	2,248		
8.30	743	9.40	997	11.00	1,442	14.00	2,790		
8.40	765	9.50	1,022	11.20	1,509	15.00	3,480		

NOTE.—The above table is based on seven discharge measurements made during 1904–5 and is fairly well defined.

Monthly discharge of Neches River at Evadale, Tex., for 1906.

[Drainage area, 8,200 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	12,300	7,760	10,100	621,000	1.23	1.42
February	9,910	5,520	7,210	400,000	0.879	0.92
March	6,380	2,910	5,090	313,000	0.621	0.72
April	7,760	3,720	5,490	327,000	0.670	0.75
May	6,000	2,010	3,980	245,000	0.485	0.56
June	3,250	1,120	2,400	143,000	0.293	0.33
July	3,640	1,150	1,940	119,000	0.237	0.27
August	4,750	854	2,600	160,000	0.317	0.37
September	1,120	560	790	47,000	0.096	0.11
October	10,100	722	3,630	223,000	0.443	0.51
November	2,010	680	1,110	66,000	0.135	0.15
December	6,000	948	2,680	165,000	0.327	0.38
The year	12,300	560	3,920	2,830,000	.478	6.49

TRINITY RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Trinity River rises in a network of small streams in the counties of Montague, Jack, Wise, Denton, and Parker, Tex., but their combined flow above Dallas is not sufficient to keep the bottom or bed of the stream moist in dry times. Below Dallas the Trinity flows through a wooded country, and consequently it is not subject to sudden floods with their quick run-offs.

TRINITY RIVER AT DALLAS, TEX.

This station was established December 28, 1905, at the Commerce Street Bridge, Dallas, Tex.

The channel is straight for 800 feet above and 100 feet below the station. The current is sluggish at low water. The right bank is low, partially cleared below the station, and during high water is subject to overflow; the left bank is high and does not overflow. The bed of the stream is composed of clay.

Discharge measurements are made from the Commerce Street Bridge or from the Texas and Pacific Railroad bridge a short distance upstream.

A standard chain gage is fastened to the downstream handrail of the Commerce Street Bridge; length of chain, 58.70 feet. The bench mark is the top of the window sill at the south window of the west side of the building of the Oliver Plow Company; elevation, 54.25 feet. The reference point is the top of the floor of the Commerce Street Bridge, under the downspout of the gage box; elevation, 53.40 feet. The reference point on the Texas and Pacific Railroad bridge is the top of the tie in the mid-panel of the bridge, upstream side; elevation, 55.95 feet. Elevations refer to the datum of the gage. This reference point is reported to be 422.00 feet above mean low tide.

Discharge measurements of Trinity River at Dallas, Tex., in 1906.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
1906.		*Feet.*	*Sec.-ft.*	1906.		*Feet.*	*Sec.-ft.*
May 6	R. J. Williams	32.6	13,000	May 10	R. J. Williams	19.4	3,270
May 6	do	32.2	11,500	May 10	do	16.9	2,320
May 7	do	31.2	9,500	May 10	do	12.9	1,350
May 7	do	29.5	7,550	May 11	do	11.3	1,080
May 7	do	27.3	6,000	May 11	do	10.0	896
May 8	do	25.8	5,140	May 12	do	9.1	770
May 8	do	25.0	4,790	June 23	T. U. Taylor	8.1	597
May 8	do	23.4	4,420	July 2	do	4.5	286
May 9	do	22.3	4,100	December 29	do	4.0	205

Daily gage height, in feet, of Trinity River at Dallas, Tex., for 1903–1906.

1903.

Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	8.8	5.7	2.8	9.9	8.3	2.0	17	4.1	4.3	1.8	4.1	2.2	1.8
2	7.9	4.3	2.5	21.5	10.2	2.0	18	3.8	4.1	1.8	3.8	2.1	1.9
3	17.7	3.8	2.4	23.5	7.3	2.0	19	3.2	3.6	1.9	3.5	2.1	2.4
4	22.6	3.3	2.4	20.6	5.1	2.1	20	3.1	3.2	1.9	3.4	2.1	2.2
5	25.6	3.1	2.5	18.5	4.2	2.1	21	3.3	3.1	1.9	3.1	2.1	2.1
6	31.5	2.9	2.2	21.1	3.8	2.0	22	3.2	3.0	1.9	2.8	2.1	2.1
7	32.1	2.9	2.4	23.9	3.5	2.0	23	3.3	2.8	1.9	2.8	2.1	2.2
8	27.8	2.8	2.2	18.5	3.2	1.9	24	3.0	2.8	1.9	2.7	2.1	2.3
9	20.2	2.7	2.2	15.5	2.9	1.9	25	3.1	2.7	1.9	2.6	2.1	2.4
10	11.1	2.5	2.1	12.2	2.7	1.9	26	3.0	2.8	1.8	2.3	2.0	2.4
11	6.5	2.5	2.1	11.0	2.7	1.9	27	2.9	2.7	1.8	2.3	2.0	2.3
12	5.8	2.4	2.1	9.3	2.6	1.9	28	2.9	2.7	1.8	2.3	2.0	2.2
13	5.4	2.4	2.0	6.5	2.5	1.8	29	2.8	2.6	2.3	2.3	2.0	2.2
14	6.5	2.5	1.9	5.8	2.5	1.8	30	3.7	2.5	3.1	2.2	2.0	2.1
15	5.5	4.6	1.8	4.2	2.3	1.8	31	8.0	2.6	.....	3.5	.....	2.1
16	4.3	4.7	1.8	4.1	2.2	1.8							

1904.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.3	2.9	2.0	4.1	6.2	5.5	8.5	3.8	2.3	2.7	5.2	2.3
2	2.3	2.8	2.0	3.5	6.8	9.4	7.1	3.7	2.3	2.4	4.3	2.3
3	2.2	2.8	2.0	3.2	5.2	10.7	4.4	3.8	2.5	3.0	3.7	2.3
4	2.2	2.7	1.9	2.9	15.1	20.9	3.8	3.8	2.7	2.8	3.4	2.2
5	2.2	2.8	1.9	3.2	23.0	24.5	3.8	3.9	2.9	2.7	3.2	2.2
6	2.1	5.2	1.9	7.5	17.8	23.8	6.3	3.9	6.2	2.5	2.9	2.5
7	2.1	6.1	1.9	6.8	19.5	20.1	4.5	5.1	6.9	2.5	2.8	2.4
8	2.3	4.8	1.9	14.6	21.8	17.9	3.8	10.4	3.4	2.5	2.7	2.4
9	2.2	4.1	1.9	18.0	15.1	16.1	3.2	7.3	4.4	2.4	2.6	2.3
10	2.1	3.7	1.8	24.8	13.2	14.8	2.9	6.2	6.8	2.5	2.4	2.3
11	2.1	3.4	1.8	25.9	8.3	12.1	2.8	5.7	6.6	2.4	2.4	2.3
12	2.1	3.1	1.8	14.2	7.2	19.4	2.6	6.3	4.9	2.3	2.4	2.2
13	2.1	2.9	1.9	7.1	6.1	20.0	2.7	7.6	3.9	2.3	2.4	2.2
14	2.1	2.5	2.2	6.3	4.5	16.7	2.5	6.8	3.4	2.4	2.4	2.2
15	2.1	2.4	2.3	5.5	3.2	11.8	2.1	5.9	3.2	2.3	2.6	2.2
16	2.1	2.4	2.1	4.9	3.1	10.9	2.2	4.8	6.0	2.1	2.5	2.4
17	2.1	2.3	3.5	7.1	3.0	8.5	2.1	3.6	7.9	2.1	2.4	2.4
18	2.0	2.3	6.8	4.3	13.8	6.3	2.0	3.2	6.5	2.2	2.4	2.4
19	2.0	2.2	5.4	3.9	8.1	5.3	2.7	3.0	4.6	2.3	2.3	2.3
20	2.0	2.2	14.5	3.2	5.2	4.6	2.4	2.9	3.7	2.3	2.6	2.3
21	2.2	2.2	21.0	2.9	4.9	4.1	2.2	2.8	3.3	2.3	2.4	2.2
22	2.5	2.1	24.7	2.7	4.5	3.7	2.5	2.7	3.8	2.2	2.4	2.4
23	5.7	2.1	17.2	3.0	4.2	6.2	2.4	2.7	3.1	2.3	2.3	2.4
24	5.6	2.1	10.1	3.6	4.0	6.0	4.0	2.5	2.9	2.2	2.3	2.4
25	5.1	2.1	5.2	4.1	3.6	7.7	3.6	2.5	2.8	2.9	2.2	2.4
26	4.2	2.1	24.8	3.9	3.5	6.3	2.8	2.4	2.5	3.4	2.2	2.3
27	3.1	2.0	27.0	3.6	3.7	4.6	2.4	2.5	2.5	11.2	2.4	2.3
28	2.7	2.0	24.0	3.4	6.8	3.8	2.3	2.2	2.4	12.8	2.4	2.2
29	3.4	2.0	10.2	3.9	5.4	4.1	2.2	2.6	2.9	6.2	2.3	2.2
30	4.5	.....	7.5	4.1	4.9	9.4	2.1	2.4	3.0	3.9	2.3	2.2
31	3.7	.....	5.6	.....	6.6	.....	2.2	2.3	.....	6.5	.....	2.2

Daily gage height, in feet, of Trinity River at Dallas, Tex., for 1903–1906—Continued.

1905.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.3	2.6	3.5	5.4	24.5	13.7	6.4	7.7	3.2	3.0	3.5	5.1
2	2.3	2.6	3.3	14.5	26.7	8.4	5.6	6.8	3.3	3.0	3.4	4.8
3	2.2	2.5	3.2	27.2	23.2	7.8	5.4	6.4	3.6	12.1	3.3	4.3
4	2.2	2.5	3.2	29.3	10.3	6.9	18.1	5.9	3.3	19.2	3.1	4.3
5	2.2	2.5	3.3	27.5	8.9	7.4	21.0	5.7	3.3	15.6	3.5	4.3
6	2.3	2.6	3.2	18.2	7.9	6.7	19.4	5.4	3.2	13.6	3.5	4.2
7	2.3	2.9	3.2	15.1	7.3	6.1	22.6	4.9	3.0	12.5	5.0	4.2
8	2.3	3.2	4.1	15.9	12.9	5.9	24.5	5.0	3.2	7.7	5.0	4.2
9	2.4	3.5	8.1	17.0	14.6	5.7	28.3	4.8	3.1	5.6	7.1	4.1
10	2.9	6.1	11.3	17.5	10.2	5.1	30.2	5.4	3.3	4.7	19.2	4.0
11	3.8	3.5	9.1	12.5	7.5	5.2	32.1	5.3	5.4	4.4	25.0	3.8
12	10.5	3.5	6.2	10.6	21.4	5.1	33.8	4.9	6.5	4.0	27.2	3.9
13	6.8	4.1	5.9	8.4	27.3	5.0	32.1	4.6	4.2	3.7	23.7	9.3
14	3.8	4.7	5.6	6.7	31.5	5.1	28.0	4.6	6.2	3.6	15.2	22.6
15	3.5	3.7	5.2	5.9	34.4	5.1	21.1	6.3	5.2	3.4	14.0	26.1
16	3.2	3.6	8.2	5.6	32.5	14.3	11.5	6.2	6.3	3.3	11.5	27.3
17	2.9	3.2	9.2	5.3	29.7	12.0	8.3	5.3	6.6	3.5	9.7	18.4
18	2.8	3.2	16.8	4.9	22.9	5.2	7.4	4.8	5.6	3.3	7.5	9.8
19	2.8	4.9	24.0	5.8	15.8	6.3	7.4	4.8	5.0	3.2	6.0	12.2
20	2.9	8.1	21.3	15.7	9.8	6.1	8.7	4.4	4.3	3.8	5.5	15.5
21	2.9	6.6	12.1	11.0	24.3	5.2	6.9	4.3	3.9	3.6	5.1	24.1
22	2.8	5.9	10.8	10.1	28.5	10.9	8.4	4.2	3.7	4.3	4.8	25.3
23	2.6	5.3	9.8	8.3	34.6	11.2	19.5	10.2	3.5	6.5	4.8	23.2
24	2.5	5.0	7.1	14.6	34.8	7.5	26.9	7.6	3.3	5.1	4.7	13.9
25	2.5	4.9	7.3	28.9	33.0	6.9	28.5	5.4	3.3	4.7	9.3	10.2
26	2.5	4.3	6.1	32.0	30.8	6.4	28.6	4.7	3.2	6.2	9.4	7.8
27	2.4	4.0	5.6	31.2	25.4	5.8	27.8	4.4	3.0	4.8	7.2	6.4
28	2.4	3.6	5.1	26.7	20.2	24.2	23.1	4.1	3.0	4.4	6.0	6.1
29	2.5	.....	8.8	20.1	19.8	21.5	16.5	3.9	3.5	4.3	5.8	5.9
30	2.5	.....	9.4	18.8	20.7	8.2	11.7	3.6	3.1	4.0	5.3	5.8
31	2.4	.....	5.7	.....	12.4	.....	9.2	3.2	.....	3.8	.....	6.9

1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.7	5.6	6.9	7.3	6.4	9.4	5.5	17.5	6.8	5.7	4.2	5.0
2	7.0	5.4	8.6	6.5	9.4	12.6	5.5	11.5	5.2	5.3	4.2	4.8
3	7.9	5.4	11.3	6.0	24.4	25.4	5.3	8.3	10.3	5.2	4.2	4.8
4	11.3	5.4	9.3	6.3	28.2	29.0	5.2	6.7	9.2	5.0	4.2	4.8
5	15.2	5.2	7.7	6.0	32.0	30.9	5.0	6.0	21.1	4.8	4.3	4.7
6	11.5	5.2	6.8	6.7	32.8	31.6	4.7	7.5	26.1	4.8	4.3	4.7
7	8.5	5.4	8.3	14.7	30.9	30.8	4.7	15.4	27.1	5.0	4.3	4.5
8	7.5	5.3	17.5	11.5	26.8	27.7	4.7	16.2	21.5	4.9	4.2	4.5
9	6.3	5.0	16.1	9.1	23.1	25.1	4.7	16.9	19.3	4.7	4.2	4.5
10	5.8	5.0	9.8	8.4	18.8	24.3	5.0	11.1	16.7	4.6	4.3	4.4
11	6.7	4.8	8.2	7.9	11.1	24.0	5.1	10.9	14.4	4.5	4.2	4.4
12	6.9	4.8	7.8	7.0	9.2	22.6	11.4	24.6	11.4	4.3	4.1	4.4
13	6.9	21.2	7.2	10.5	8.9	17.1	7.6	28.6	17.3	4.3	4.1	4.6
14	7.0	27.5	7.0	15.5	8.0	10.4	9.0	29.3	15.0	4.3	4.1	4.6
15	6.9	27.3	6.8	10.6	15.4	9.0	7.8	29.3	12.9	4.0	4.1	4.8
16	6.5	18.3	6.7	8.9	28.5	8.6	7.3	24.6	10.3	4.6	4.1	5.8
17	6.4	9.9	6.5	6.9	32.0	8.6	15.2	14.4	8.9	5.2	4.1	7.7
18	6.2	8.6	6.5	6.5	34.9	8.5	22.2	11.6	7.6	5.9	4.1	8.9
19	5.9	8.2	6.9	6.5	34.6	7.9	24.5	13.8	7.6	5.3	4.3	7.8
20	5.6	12.5	7.1	6.5	31.6	7.3	13.1	11.5	6.9	5.0	4.4	7.3
21	6.2	23.1	7.1	19.6	26.9	7.3	9.8	10.0	6.3	5.0	4.4	6.8
22	6.4	25.2	6.8	24.1	27.1	14.0	7.7	10.2	5.9	4.9	4.4	6.2
23	6.3	17.5	6.5	21.0	26.8	8.1	7.3	9.4	5.7	4.9	4.5	5.6
24	6.1	11.3	6.3	12.3	24.3	6.9	7.3	8.0	5.5	4.8	4.8	5.3
25	6.1	11.0	6.9	8.8	17.8	6.5	7.2	7.2	7.8	4.8	5.3	5.2
26	6.1	9.5	13.8	7.8	24.7	7.0	19.8	6.8	15.8	4.6	6.2	5.0
27	6.2	7.9	14.7	7.2	24.0	8.6	24.3	6.7	14.5	4.5	6.4	4.6
28	6.9	7.4	7.7	6.7	17.7	7.5	25.4	6.0	9.8	4.5	6.1	4.1
29	6.3	.....	6.7	6.7	14.5	6.3	22.9	5.9	7.4	4.5	5.8	4.0
30	6.2	.....	5.9	6.4	12.6	5.9	25.6	5.6	6.3	4.3	5.4	4.5
31	6.0	.....	8.5	.....	10.3	.....	26.4	5.4	.....	4.3	.....	4.8

Rating table for Trinity River at Dallas, Tex., for 1903–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.80	105	3.30	183	4.80	284	7.00	557	21.00	3,460
1.90	110	3.40	189	4.90	292	7.80	581	22.00	3,800
2.00	115	3.50	195	5.00	300	8.00	605	23.00	4,100
2.10	120	3.60	201	5.20	318	9.00	735	24.00	4,540
2.20	125	3.70	207	5.40	336	10.00	875	25.00	4,900
2.30	130	3.80	213	5.60	354	11.00	1,030	26.00	5,410
2.40	135	3.90	219	5.80	372	12.00	1,200	27.00	5,910
2.50	140	4.00	225	6.00	390	13.00	1,390	28.00	6,500
2.60	145	4.10	232	6.20	410	14.00	1,590	29.00	7,180
2.70	150	4.20	239	6.40	430	15.00	1,810	30.00	8,050
2.80	155	4.30	246	6.60	450	16.00	2,040	31.00	9,250
2.90	160	4.40	253	6.80	470	17.00	2,290	32.00	11,000
3.00	165	4.50	260	7.00	490	18.00	2,550	33.00	13,190
3.10	171	4.60	268	7.20	512	19.00	2,830	34.00	15,530
3.20	177	4.70	276	7.40	534	20.00	3,130	35.00	18,000

NOTE.—The above table is based on seventeen discharge measurements made during 1906 and is well defined between gage heights 4.0 feet and 33.0 feet. There is more or less uncertainty in applying this table to gage heights prior to 1906, because of the lack of definite information concerning the permanency of the gaging section. This must be determined by future measurements.

Monthly discharge of Trinity River at Dallas, Tex., for 1903–1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1903.				
July	11,200	155	1,620	99,600
August	363	135	180	11,100
September	171	105	120	7,140
October	4,500	125	1,100	67,600
November	905	115	200	11,900
December	135	105	118	7,260
The period				205,000
1904.				
January	363	115	159	9,780
February	400	115	163	9,380
March	5,910	105	1,080	66,400
April	5,360	150	758	45,100
May	4,160	165	892	54,800
June	4,740	207	1,380	82,100
July	670	115	195	12,000
August	935	125	264	16,200
September	593	130	245	14,600
October	1,350	120	228	14,000
November	318	125	152	9,040
December	140	125	130	7,990
The year	5,910	105	470	341,000
1905.				
January	950	125	185	11,400
February	618	140	242	13,400
March	4,540	177	779	47,900
April	11,000	292	2,780	165,000
May	17,500	523	5,460	336,000
June	4,620	300	811	48,300
July	15,000	336	3,970	244,000
August	905	177	340	20,900
September	450	165	239	14,200
October	2,890	165	501	30,800
November	6,020	171	1,050	62,500
December	6,080	213	1,450	89,200
The year	17,500	171	1,480	1,080,000
1906.				
January	1,860	354	535	32,900
February	6,200	284	1,480	82,200
March	2,420	381	733	45,100
April	4,580	390	993	59,100
May	17,800	430	5,370	330,000
June	10,200	381	2,690	160,000
July	5,610	276	1,600	98,400
August	7,420	336	1,830	113,000
September	5,960	318	1,510	89,800
October	381	225	285	17,500
November	430	232	270	16,100
December	722	225	332	20,400
The year	17,800	225	1,470	1,060,000

TRINITY RIVER AT RIVERSIDE, TEX.

This station was established on Trinity River at Riverside, Tex., in December, 1902, at the bridge of the International and Great Northern Railroad. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 17, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of Trinity River at Riverside, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	33.1	20.7	28.6	15.2	23.7	27.7	14.8	17.0	12.2	11.1	9.6	13.7
2	33.6	19.5	27.7	17.0	23.6	30.2	15.4	17.9	11.2	12.3	9.3	14.2
3	36.0	18.0	26.7	18.0	20.9	30.7	15.2	18.4	11.2	13.1	9.1	14.1
4	36.3	17.2	25.8	18.7	18.6	31.5	14.3	18.9	11.2	13.1	9.1	13.7
5	36.6	16.7	24.9	18.8	17.1	32.2	13.3	19.3	13.0	12.2	9.0	12.7
6	36.6	16.0	23.7	19.0	15.8	32.8	12.1	19.8	13.5	11.3	9.0	11.7
7	36.3	15.7	21.0	18.3	15.9	33.2	11.2	20.5	13.5	10.5	8.9	11.1
8	35.5	15.2	18.2	17.7	18.7	33.5	10.8	20.6	12.5	10.1	8.8	10.5
9	34.3	15.4	16.2	17.4	20.4	33.6	10.4	20.6	11.3	9.8	8.8	10.2
10	33.0	14.2	15.5	18.0	20.9	33.6	10.4	20.7	12.7	8.6	8.7	10.0
11	30.7	13.7	15.1	18.4	21.3	33.3	9.9	20.8	15.0	8.4	8.6	9.7
12	26.6	13.2	14.7	19.1	21.7	32.9	13.7	21.1	16.4	8.2	8.6	8.6
13	21.7	17.2	15.0	19.7	22.1	32.4	10.4	20.7	17.4	8.1	8.5	8.5
14	18.5	22.6	16.0	21.0	22.3	32.0	10.2	19.7	18.0	8.2	8.5	8.5
15	16.9	27.0	16.8	20.5	22.7	31.7	12.2	18.4	18.2	9.9	8.5	8.4
16	16.2	29.7	16.4	19.5	23.1	31.5	12.0	16.9	18.5	11.3	8.4	10.0
17	15.8	29.5	15.6	17.5	23.6	31.4	11.8	15.9	18.1	11.8	8.4	14.2
18	15.3	28.3	14.7	16.0	24.1	31.0	14.0	16.7	17.2	11.5	8.4	20.2
19	14.7	27.2	14.0	16.0	24.8	30.6	14.9	17.4	16.0	11.3	8.4	22.5
20	14.1	26.7	13.6	16.5	25.6	30.0	14.4	18.2	15.0	11.7	8.4	23.2
21	14.7	26.7	13.2	16.5	26.6	29.4	13.3	18.7	14.4	12.0	8.4	23.7
22	26.5	27.1	12.9	15.5	27.4	28.8	12.3	19.1	13.7	12.2	8.3	24.2
23	31.2	27.5	12.6	14.6	28.4	28.2	13.4	19.5	13.0	11.9	8.3	25.1
24	29.5	28.3	12.5	14.0	28.0	27.2	16.0	19.6	11.7	11.4	8.5	25.9
25	25.7	28.8	12.4	14.2	28.2	25.0	17.0	19.8	11.3	11.1	8.6	27.0
26	22.2	28.2	12.3	15.0	28.2	19.7	17.5	20.2	11.2	10.9	8.7	28.4
27	20.7	28.2	12.2	16.2	27.3	15.2	17.2	20.5	11.4	10.7	8.8	29.7
28	21.1	27.9	12.2	17.4	28.3	15.2	15.7	20.7	10.8	10.5	9.0	30.7
29	21.5	.....	12.7	18.1	27.6	15.2	14.4	20.3	10.7	10.3	10.1	31.7
30	21.7	.....	12.7	21.4	27.1	14.6	17.2	18.4	10.5	10.1	12.2	32.4
31	21.5	.....	13.7	.....	27.1	.....	16.0	15.1	.....	9.9	.....	32.6

Monthly discharge of Trinity River at Riverside, Tex., for 1906.

[Drainage area, 16,000 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	22,800	3,700	13,200	812,000	0.825	0.95
February	16,400	3,100	10,300	572,000	0.644	.67
March	15,400	2,460	5,840	359,000	0.365	.42
April	9,290	3,630	6,240	371,000	0.390	.44
May	15,200	4,930	11,200	689,000	0.700	.81
June	19,900	4,060	15,500	922,000	0.969	1.08
July	6,220	1,100	3,450	212,000	0.216	.25
August	9,040	4,420	7,450	458,000	0.466	.54
September	6,980	1,430	3,530	210,000	0.221	.25
October	3,030	386	1,650	101,000	0.103	.12
November	2,460	441	660	39,300	0.041	.05
December	19,000	471	7,400	455,000	0.462	.53
The year	22,800	386	7,200	5,200,000	.450	6.11

NOTE.—The above discharges are liable to large error for low and medium stages, owing to the inconsistent data on which they are based.

BRAZOS RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

This river has its source in the Staked Plains region of western Texas in Hale and Lamb counties, flows in a general southeasterly direction, and empties into the Gulf of Mexico south of the mouth of Trinity River. In its upper stretches, above Young County, it flows through flat plains, and is unreliable for power purposes. Its drainage basin is entirely within the State of Texas.

BRAZOS RIVER AT WACO, TEX.

This station was established September 14, 1898, at the suspension bridge on Bridge street, Waco, Tex. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 19, where are given also references to publications that contain data for previous years. During 1906 the gage was read twice each day by W. J. Cassaday.

Daily gage height, in feet, of Brazos River at Waco, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.5	3.0	3.0	2.85	3.45	5.95	4.0	5.5	4.1	4.5	3.9	3.6
2	3.5	3.0	3.0	2.8	3.25	8.4	4.0	5.4	4.0	4.5	3.8	3.6
3	3.6	*2.95	3.0	2.85	3.3	12.0	4.5	5.0	4.0	4.4	3.7	3.5
4	3.75	2.9	3.0	2.85	10.25	16.15	4.5	4.7	4.5	4.4	3.7	3.5
5	3.6	2.9	2.9	2.85	9.55	17.40	4.1	4.6	7.5	4.2	3.7	3.5
6	3.6	2.9	2.95	3.1	8.1	19.8	3.8	5.8	8.2	4.2	3.7	3.4
7	3.6	2.9	3.2	3.15	7.45	17.7	3.6	5.2	7.6	4.1	3.5	3.3
8	3.55	2.9	3.3	3.0	6.55	13.25	3.4	5.2	9.1	4.1	3.5	3.2
9	3.5	2.9	3.1	2.95	5.95	12.55	3.3	4.9	7.7	4.1	3.5	3.2
10	3.5	2.9	3.05	2.9	5.1	11.55	3.3	8.2	7.0	4.0	3.4	3.2
11	3.5	2.85	3.0	2.9	5.05	10.50	3.2	7.8	6.6	4.0	3.4	3.2
12	3.4	2.95	3.0	2.9	4.4	8.85	4.2	9.1	6.1	3.9	3.4	4.1
13	3.4	5.75	3.0	2.9	4.45	6.70	5.4	10.8	5.8	3.9	3.4	4.3
14	3.4	4.95	3.0	2.9	4.50	5.90	5.1	9.7	5.5	3.9	3.3	4.3
15	3.35	4.7	2.9	2.9	4.2	5.55	4.6	10.0	5.4	3.8	3.3	7.5
16	3.2	4.2	2.9	2.85	4.25	5.35	4.1	9.2	5.1	3.8	3.3	6.6
17	3.2	4.1	2.9	2.8	5.8	5.4	6.2	8.0	5.1	3.8	3.2	5.4
18	3.15	4.05	2.9	3.4	6.6	4.95	5.6	7.6	5.5	3.7	3.2	5.1
19	3.1	3.95	2.9	3.6	6.05	4.8	7.5	7.2	5.4	3.7	3.2	4.6
20	3.1	3.8	2.9	3.75	6.05	4.8	8.4	6.5	5.5	3.7	3.2	4.5
21	3.2	3.6	2.85	4.5	5.9	4.45	9.5	5.9	5.3	6.5	3.2	4.5
22	3.35	3.5	2.8	4.75	5.35	4.5	7.7	6.0	5.3	6.0	3.2	4.4
23	3.3	3.4	2.9	4.2	5.15	4.4	10.4	5.5	5.0	5.6	3.1	4.1
24	3.15	3.55	2.85	3.95	6.45	4.15	8.0	5.5	4.9	5.3	3.5	4.1
25	3.1	3.45	2.8	3.75	9.55	4.2	7.6	5.2	5.5	5.0	3.4	4.0
26	3.1	3.2	2.8	2.95	7.4	4.6	7.4	5.0	5.0	4.6	3.4	3.9
27	3.05	3.1	2.8	2.8	9.1	4.6	6.5	4.7	5.2	4.3	3.5	3.9
28	3.0	3.05	2.85	2.8	9.65	4.7	6.3	4.6	5.5	4.0	3.7	3.9
29	3.0	.....	3.15	3.5	7.6	4.25	5.9	4.4	5.1	4.1	3.7	3.9
30	3.0	.....	3.15	3.55	6.95	3.9	5.5	4.3	5.0	4.0	3.7	3.8
31	3.0	.....	3.00	.....	6.25	.....	5.2	4.1	.....	4.0	.....	3.7

Rating table for Brazos River at Waco, Tex., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.80	284	3.80	900	4.80	1,795	6.60	4,055	11.00	12,510
2.90	323	3.90	980	4.90	1,900	6.80	4,345	12.00	14,900
3.00	365	4.00	1,065	5.00	2,005	7.00	4,645	13.00	17,450
3.10	410	4.10	1,150	5.20	2,225	7.20	4,955	14.00	20,200
3.20	460	4.20	1,235	5.40	2,455	7.40	5,275	15.00	23,180
3.30	520	4.30	1,320	5.60	2,700	7.60	5,605	16.00	26,400
3.40	590	4.40	1,410	5.80	2,955	7.80	5,945	17.00	29,850
3.50	665	4.50	1,500	6.00	3,220	8.00	6,300	18.00	33,500
3.60	740	4.60	1,595	6.20	3,490	9.00	8,190	19.00	37,500
3.70	820	4.70	1,695	6.40	3,770	10.00	10,260	20.00	41,700

NOTE.—The above table is based on discharge measurements made during 1900–1905 and is well defined.

Monthly discharge of Brazos River at Waco, Tex., for 1906.

[Drainage area, 30,800 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	860	365	548	33,700	0.018	0.02
February	2,890	304	733	40,700	0.024	0.02
March	520	284	352	21,600	0.011	0.01
April	1,740	284	547	32,500	0.018	0.02
May	10,800	490	3,970	244,000	0.129	0.15
June	40,900	980	8,610	512,000	0.280	0.31
July	11,100	460	3,090	190,000	0.100	0.12
August	12,000	1,150	4,020	247,000	0.131	0.15
September	8,390	1,060	3,020	180,000	0.098	0.11
October	3,910	820	1,400	86,100	0.046	0.05
November	980	460	640	38,100	0.021	0.02
December	5,440	460	1,270	78,100	0.041	0.05
The year	40,900	284	2,350	1,700,000	.076	1.03

BRAZOS RIVER AT RICHMOND, TEX.

This station was established January 1, 1903, and was discontinued June 30, 1906. It is located at the bridge of the Southern Pacific Railroad. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 21, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of Brazos River at Richmond, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	6.4	3.3	5.7	2.4	3.1	8.1	17	3.7	3.5	2.8	5.4	3.9	7.2
2	6.3	3.2	5.4	2.5	5.0	7.3	18	3.5	10.5	2.8	7.0	3.7	6.5
3	6.3	3.2	5.1	2.7	4.9	6.5	19	3.3	9.6	2.8	5.8	3.6	6.2
4	6.2	3.2	4.0	2.9	4.7	5.6	20	3.2	8.3	2.7	4.4	3.5	5.3
5	6.1	3.1	3.8	3.0	4.3	9.0	21	3.2	7.9	2.7	3.4	3.3	5.2
6	6.1	3.4	3.6	2.9	4.3	14.0	22	4.7	7.5	2.5	3.4	4.9	4.6
7	5.6	3.5	3.4	2.8	4.7	17.1	23	5.4	7.1	2.4	3.2	4.8	4.3
8	5.3	3.8	3.2	2.7	5.4	19.5	24	6.1	7.1	2.4	3.1	4.6	4.3
9	4.0	3.4	3.2	2.7	8.3	21.2	25	5.9	6.9	2.5	4.0	4.5	4.1
10	4.1	3.1	3.0	2.7	7.0	18.4	26	6.0	6.4	2.4	4.6	4.5	4.0
11	4.3	2.9	3.0	2.6	6.5	16.1	27	6.0	6.2	2.4	4.3	9.0	3.9
12	4.3	2.7	2.9	2.4	5.8	14.2	28	5.1	5.9	2.3	3.8	11.0	4.1
13	4.3	2.7	2.8	2.3	5.1	12.1	29	5.3	.....	2.3	3.6	9.5	4.3
14	4.1	2.7	2.8	2.3	4.7	10.5	30	4.1	.....	2.3	3.3	9.5	4.3
15	4.0	3.1	2.8	2.3	4.4	9.2	31	3.4	.....	2.3	.....	9.5	.....
16	3.9	3.2	2.8	2.4	4.1	8.1							

Rating table for Brazos River at Richmond, Tex., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.30	1,290	3.40	2,180	4.50	3,310	6.00	5,120	8.00	7,950
2.40	1,360	3.50	2,270	4.60	3,420	6.20	5,380	8.20	8,250
2.50	1,430	3.60	2,370	4.70	3,530	6.40	5,660	8.40	8,550
2.60	1,500	3.70	2,470	4.80	3,640	6.60	5,940	8.60	8,850
2.70	1,580	3.80	2,570	4.90	3,760	6.80	6,220	8.80	9,160
2.80	1,660	3.90	2,670	5.00	3,880	7.00	6,500	9.00	9,480
2.90	1,740	4.00	2,770	5.20	4,120	7.20	6,780	10.00	11,120
3.00	1,820	4.10	2,870	5.40	4,360	7.40	7,060	11.00	13,020
3.10	1,910	4.20	2,980	5.60	4,600	7.60	7,350	12.00	15,270
3.20	2,000	4.30	3,090	5.80	4,860	7.80	7,650	13.00	17,590
3.30	2,090	4.40	3,200						

NOTE.—The above table is based on discharge measurements made during 1902–1905 and is well defined, Above gage height 13.0 feet the rating curve is a tangent, the difference being 240 per tenth.

Monthly discharge of Brazos River at Richmond, Tex., for 1906.

[Drainage area, 44,000 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec-ft. per sq. mile.	Depth in inches.
January	5,660	2,000	3,780	232,000	0.086	0.10
February	12,000	1,580	4,120	229,000	0.094	0.10
March	4,730	1,290	1,950	120,000	0.044	0.05
April	6,500	1,290	2,260	134,000	0.051	0.06
May	13,000	1,910	4,810	296,000	0.109	0.13
June	37,300	2,670	10,900	649,000	0.248	0.28
The period				1,660,000		

LAMPASAS SPRINGS AT LAMPASAS, TEX.

Sulphur Fork of Lampasas River rises in the town of Lampasas in two springs, the Hancock and the Hanna. Hancock Spring is about 1 mile S. 30° W. from the court-house, on the east bank of a fork of the Sulphur. The Hanna Spring is in the city of Lampasas and is about one-fourth mile N. 20° E. from the court-house. Around the head of the spring a pool about 60 feet in diameter has been constructed of stone and cement. The water issues from this over an inclined apron and can be diverted to a large bath house or permitted to run off through an underground conduit, across which boxes have been fitted, with the top omitted, so that the stream is visible and can be measured. The Hanna Spring is strongly impregnated with sulphur.

Discharge measurements of the Hancock and Hanna springs, Lampasas, Tex.

Date.	Hydrographer.	Discharge.	
		Hancock.[a]	Hanna.
December, 1900.	T. U. Taylor	10.3	4.0
December, 1901.	do	11.0	1.5
August, 1902	do	7.6	1.4
February, 1906.	do	8.1	1.6

[a] These measurements include the flow of the spring and the small discharge of the stream.

The joint discharge of these streams is used within 2 miles of the town of Lampasas for three power plants, which are fully described in Water-Supply Paper No. 105.

COLORADO RIVER (OF TEXAS) DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Colorado River rises in the extreme western portion of Texas, within a few miles of the eastern boundary of New Mexico, flows in a general southeasterly direction, and empties into the Gulf of Mexico in Matagorda County. The drainage area above Austin is 37,000 square miles and above Columbus 40,000 square miles; it includes the corner of New Mexico. Its main tributaries are the Concho, the San Saba, and the Llano. The Concho has a reliable flow and contributes a greater amount of water than the Colorado at their junction. The Concho furnishes water for irrigation and water power, and supports, in Irion and Tom Green counties, some excellent irrigation systems, described in Water-Supply Paper No. 71. San Saba and Llano rivers are described in the same paper.

The Colorado at Austin emerges from a canyon. From Austin to the Gulf it traverses a rather flat country, where its waters are utilized for many power plants, and are extensively used for rice irrigation in Colorado, Wharton, and Matagorda counties.

COLORADO RIVER AT AUSTIN, TEX.

This station was established December 21, 1897. It was originally located at the dam near Austin, Tex., and on the failure of this dam was removed to the Congress Avenue Bridge, south of the city. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 24, where are given also references to publications that contain data for previous years.

Discharge measurements of Colorado River at Austin, Tex., in 1906.

Date.	Hydrographer.	Gage height.	Discharge.	Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*			*Feet.*	*Sec.-ft.*
June 8	Carl Blucher	8.1	25,800	June 9	H. H. Fox	4.9	7,440
June 8	do	7.5	20,500	June 10	do	4.5	5,820
June 9	do	5.5	10,400	June 11	do	3.9	4,020
June 9	do	4.9	7,430				

Daily gage height, in feet, of Colorado River at Austin, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.1	0.9	0.9	1.3	1.4	1.8	2.6	3.1	3.2	2.3	1.8	1.2
2	1.1	.9	.9	1.3	1.4	1.8	2.6	2.8	3.1	2.2	1.8	1.2
3	1.1	.8	.9	1.3	1.3	1.8	2.5	2.7	3.2	2.2	1.8	1.2
4	1.1	.9	.9	1.3	1.3	1.7	3.0	2.5	3.3	2.2	1.7	1.2
5	1.0	.9	.9	1.4	1.4	1.7	2.9	2.5	3.6	2.1	1.6	1.3
6	1.0	1.0	1.0	1.5	1.4	2.8	3.4	2.5	7.9	1.9	1.5	1.3
7	1.0	.9	.9	1.5	1.4	11.3	3.4	2.4	8.4	1.8	1.5	1.2
8	1.0	.9	.9	1.5	1.3	8.1	3.9	2.4	7.1	1.6	1.4	1.2
9	1.0	.9	.9	1.4	1.3	5.5	4.3	2.4	5.2	1.6	1.2	1.4
10	1.0	.9	.9	1.4	1.2	4.5	4.4	5.6	3.8	1.5	1.2	2.8
11	.9	.9	.9	1.3	1.2	3.9	4.8	14.8	3.7	1.5	1.1	2.6
12	.9	.9	1.0	1.4	1.1	3.2	4.5	19.5	3.6	1.5	1.0	2.5
13	.9	.9	1.0	1.4	1.1	2.9	4.4	16.3	8.3	1.5	1.0	2.5
14	.9	1.5	1.0	1.3	1.2	2.7	5.8	11.1	8.1	1.4	.9	2.5
15	.9	1.4	1.0	1.3	1.3	2.4	5.6	7.4	8.0	1.4	.9	2.6
16	.9	1.4	.9	1.2	1.3	2.2	5.3	5.1	8.2	1.4	1.0	2.6
17	.9	1.3	.9	1.3	1.4	2.0	5.2	9.6	8.1	1.4	1.0	2.9
18	1.0	1.2	.9	2.5	1.3	2.0	4.1	10.3	7.3	1.4	.9	2.9
19	1.0	1.2	.9	2.8	1.3	2.0	5.8	7.1	7.1	1.4	1.1	2.6
20	1.0	1.3	.9	3.2	1.3	1.8	5.8	5.8	5.4	1.4	1.2	2.4
21	1.0	1.3	.9	3.3	1.7	1.8	5.7	4.2	5.1	1.4	1.2	2.4
22	1.0	1.2	.9	3.3	1.6	1.9	5.8	4.1	4.8	1.3	1.1	2.4
23	1.0	1.1	.9	3.2	1.6	1.9	5.6	4.1	4.5	1.2	1.1	2.3
24	1.0	1.0	1.0	2.6	2.0	1.7	5.4	3.0	4.1	1.2	1.6	2.3
25	1.0	.9	1.0	2.3	2.8	1.6	5.4	3.8	3.8	1.1	1.7	2.0
26	1.0	.9	.9	2.2	4.3	1.5	5.0	3.8	3.8	1.1	1.8	2.0
27	1.0	.8	.9	2.0	5.4	1.5	4.3	3.5	3.5	1.1	1.5	1.9
28	1.0	.8	2.2	1.8	3.8	1.5	3.8	3.4	2.7	1.1	1.5	1.8
29	1.0	.....	2.1	1.7	3.4	1.5	3.4	3.3	2.6	1.1	1.5	1.7
30	.9	.....	1.6	1.4	3.2	1.5	3.3	3.0	2.5	1.1	1.5	1.5
31	.9	.....	1.4	.....	3.1	.....	2.9	3.1	.....	1.1	.....	1.5

Rating table for Colorado River at Austin, Tex., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.80	175	1.90	790	3.00	2,260	4.20	5,170
0.90	195	2.00	885	3.10	2,450	4.40	5,810
1.00	220	2.10	990	3.20	2,650	4.60	6,510
1.10	250	2.20	1,105	3.30	2,860	4.80	7,270
1.20	290	2.30	1,225	3.40	3,070	5.00	8,080
1.30	340	2.40	1,345	3.50	3,290	5.20	8,920
1.40	400	2.50	1,470	3.60	3,530	5.40	9,760
1.50	470	2.60	1,605	3.70	3,780	5.60	10,600
1.60	540	2.70	1,750	3.80	4,040	5.80	11,440
1.70	620	2.80	1,910	3.90	4,310	6.00	12,280
1.80	700	2.90	2,080	4.00	4,580	6.20	13,130

NOTE.—The above table is based on discharge measurements made during 1904–1906 and is well defined between gage heights 0.8 feet and 6.0 feet. Above gage height 6.1 feet the rating curve is a tangent, the difference being 430 per tenth.

Monthly discharge of Colorado River at Austin, Tex., for 1906.

[Drainage area, 37,000 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	250	195	217	13,300	0.0059	.01
February	470	175	247	13,700	0.0067	.01
March	1,100	195	273	16,800	0.0074	.01
April	2,860	290	912	54,300	0.025	.03
May	9,760	250	1,250	76,900	0.034	.04
June	35,100	470	3,350	199,000	0.090	.10
July	11,400	1,470	6,320	389,000	0.171	.20
August	70,300	1,340	12,600	775,000	0.341	.39
September	22,600	1,470	9,650	574,000	0.261	.29
October	1,220	250	511	31,400	0.014	.02
November	700	195	399	23,700	0.011	.01
December	2,080	290	999	61,400	0.027	.03
The year	70,300	175	3,060	2,230,000	.083	1.14

COLORADO RIVER AT COLUMBUS, TEX.

This station was established in December, 1902, at the highway bridge east of Columbus. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 27, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of Colorado River at Columbus, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.1	6.6	7.0	7.5	7.8	11.0	10.0	8.5	9.0	8.5	7.5	6.9
2	7.1	6.6	7.0	7.1	7.5	10.5	9.0	8.2	8.6	8.4	7.5	6.9
3	7.0	6.6	6.9	6.85	7.5	10.0	8.5	8.1	8.6	8.4	7.4	6.9
4	7.0	6.6	6.8	6.7	7.1	9.4	8.0	8.3	8.6	8.4	7.4	6.7
5	7.0	6.6	6.8	6.6	7.1	8.4	7.6	8.0	8.6	8.0	7.4	6.5
6	6.9	6.6	6.8	6.55	7.1	8.0	7.4	8.3	8.5	8.0	7.4	6.8
7	6.9	6.6	6.8	6.5	7.0	8.0	8.0	7.9	13.0	8.0	7.4	6.9
8	6.9	6.6	6.8	6.5	7.0	15.8	7.7	7.6	16.0	8.0	7.3	6.9
9	6.8	6.6	6.8	6.4	6.9	22.5	7.5	7.7	14.2	8.0	7.3	7.0
10	6.8	6.6	6.8	6.4	6.9	20.5	7.4	8.6	14.9	8.0	7.3	7.0
11	6.8	6.6	6.8	6.4	6.7	14.0	7.3	23.7	13.2	8.0	7.3	7.0
12	6.8	6.6	6.8	6.4	6.5	11.8	7.2	28.0	12.2	8.0	7.2	7.0
13	6.8	14.25	6.8	6.4	6.5	11.0	7.2	30.2	14.2	8.0	7.2	7.0
14	6.8	16.25	6.7	6.7	6.5	10.0	7.2	32.0	18.0	7.9	7.2	7.1
15	6.8	10.6	6.7	6.8	6.5	10.5	7.7	33.5	15.1	7.9	7.2	7.1
16	6.7	9.4	6.7	6.8	6.5	9.0	10.7	24.2	13.5	7.8	7.0	7.2
17	6.7	7.9	6.7	6.9	6.4	8.5	12.4	26.2	11.8	7.8	6.9	8.2
18	6.6	7.5	6.7	7.0	6.4	8.0	15.2	23.0	11.7	7.8	7.2	8.1
19	6.6	7.5	6.7	7.05	6.3	8.0	11.8	16.0	11.4	7.7	7.2	8.1
20	6.6	7.4	6.6	7.1	6.3	7.8	11.4	14.8	11.2	7.7	7.2	8.1
21	6.8	7.3	6.6	7.15	6.3	7.6	10.4	13.7	11.0	7.7	7.2	8.1
22	7.6	7.3	6.6	7.35	6.3	7.6	14.0	12.6	10.5	7.7	7.0	8.2
23	6.8	7.15	6.5	7.4	6.3	7.4	14.2	12.0	10.0	7.7	7.1	8.0
24	6.7	7.1	6.5	7.2	6.2	7.4	11.8	11.6	10.0	7.6	7.1	8.0
25	6.6	7.1	6.5	7.0	7.0	7.2	11.6	11.2	9.5	7.6	7.0	7.8
26	6.6	7.1	6.5	7.0	8.0	7.1	10.0	10.7	9.0	7.6	7.1	7.6
27	6.5	7.1	6.5	6.9	9.0	7.0	9.6	10.3	9.0	7.5	7.0	7.0
28	6.5	7.1	6.5	6.9	9.0	7.0	9.2	10.0	9.0	7.5	7.0	6.5
29	6.5	.....	8.5	7.0	10.0	10.0	8.8	9.8	9.0	7.5	7.0	6.4
30	6.6	.....	10.85	7.5	11.8	12.4	8.5	9.6	8.5	7.5	7.0	6.4
31	6.6	.....	8.7	.....	11.6	.....	9.2	9.3	.....	7.5	.....	6.2

Rating table for Colorado River at Columbus, Tex., for 1904–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
6.20	880	7.50	1,580	8.80	2,430	12.00	4,850	25.00	22,200
6.30	930	7.60	1,640	8.90	2,500	13.00	5,710	26.00	24,070
6.40	980	7.70	1,700	9.00	2,570	14.00	6,610	27.00	25,980
6.50	1,030	7.80	1,760	9.20	2,710	15.00	7,590	28.00	27,920
6.60	1,080	7.90	1,820	9.40	2,850	16.00	8,660	29.00	29,860
6.70	1,130	8.00	1,880	9.60	2,990	17.00	9,860	30.00	31,800
6.80	1.180	8.10	1,940	9.80	3,130	18.00	11,140	31.00	33,740
6.90	1,230	8.20	2,010	10.00	3,270	19.00	12,520	32.00	35,680
7.00	1,280	8.30	2,080	10.20	3,410	20.00	13,970	33.00	37,620
7.10	1,340	8.40	2,150	10.40	3,570	21.00	15,470	34.00	39,560
7.20	1,400	8.50	2,220	10.60	3,730	22.00	17,030		
7.30	1,460	8.60	2,290	10.80	3,890	23.00	18,700		
7.40	1,520	8.70	2,360	11.00	4,050	24.00	20,420		

NOTE.—The above table is based on discharge measurements made during 1902–1905 and is well defined

Monthly discharge of Colorado River at Columbus, Tex., for 1906.

[Drainage area, 40,000 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	1,640	1,030	1,180	72,600	0.030	0.03
February	8,960	1,080	1,890	105,000	.047	.05
March	3,930	1,030	1,300	79,900	.032	.04
April	1,580	980	1,220	72,600	.030	.03
May	4,690	880	1,570	96,500	.039	.04
June	17,900	1,280	3,780	225,000	.094	.10
July	7,790	1,400	3,080	189,000	.077	.09
August	38,600	1,640	9,640	593,000	.241	.28
September	11,100	2,220	4,430	264.000	.111	.12
October	2,220	1,580	1,800	111,000	.045	.05
November	1,580	1,230	1,400	83,300	.035	.04
December	2,010	880	1,420	87,300	.036	.04
The year	38,600	880	2,730	1,980,000	.068	.91

SAN SABA RIVER NEAR SAN SABA, TEX.

This station was established December 30, 1904, 1 mile northwest of the town of San Saba, Tex. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 29, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of San Saba River near San Saba, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.8	7.8	7.8	7.5	7.6	7.8	7.4	7.6	7.8	7.7	7.6	7.8
2	7.8	7.8	7.8	7.5	7.7	7.8	7.4	7.6	7.8	7.7	7.6	7.8
3	7.8	7.8	7.8	7.5	7.7	7.8	7.4	8.3	7.8	7.7	7.6	7.8
4	7.8	7.8	7.8	7.5	7.7	7.9	7.4	7.8	10.1	7.7	7.6	7.8
5	7.7	7.8	7.8	7.5	7.6	7.8	7.4	7.9	9.2	7.6	7.6	7.8
6	7.7	7.8	7.8	7.5	7.6	7.8	7.4	8.2	9.8	7.6	7.6	7.8
7	7.7	7.8	7.8	7.5	7.6	7.8	7.4	31.7	10.0	7.6	7.6	7.7
8	7.7	7.8	7.8	7.6	7.6	7.8	7.4	11 3	8.6	7.6	7.6	7.7
9	7.7	7.8	7.8	7.6	7.6	7.8	7.4	9.1	8.2	7.6	7.6	7.7
10	7.7	7.8	7.8	7.6	7.6	7.7	7.4	8.8	8.1	7.5	7.6	7.7

Daily gage height, in feet, of San Saba River near San Saba, Tex., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	7.8	7.8	7.8	7.6	7.6	7.7	7.4	8.2	8.0	7.5	7.6	7.7
12	7.8	7.8	7.8	7.6	7.6	7.7	13.6	8.3	7.9	7.5	7.6	7.7
13	7.8	7.8	7.8	7.6	7.5	7.7	14.5	10.1	8.3	7.6	7.6	7.7
14	7.8	7.8	7.8	7.6	7.5	7.6	8.6	10.1	8.2	7.6	7.6	7.8
15	7.8	7.8	7.8	7.5	7.5	7.6	7.4	8.5	7.9	7.6	7.6	7.8
16	7.8	7.8	7.7	7.5	7.5	7.5	7.5	8.5	7.8	7.7	7.6	7.7
17	7.9	7.8	7.7	7.5	7.5	7.5	7.6	8.2	7.8	7.7	7.6	7.8
18	7.9	7.8	7.6	7.6	7.5	7.5	7.6	8.0	7.8	7.7	7.6	7.7
19	7.9	7.8	7.6	7.7	7.4	7.5	7.6	8.0	7.8	7.7	7.6	7.7
20	7.9	7.8	7.6	7.7	7.4	7.4	7.7	8.0	7.8	7.7	7.6	7.7
21	7.8	7.8	7.6	7.7	7.5	10.3	8.1	8.0	7.8	7.7	7.6	7.7
22	7.8	7.8	7.6	7.7	7.5	7.6	8.0	8.1	7.7	7.7	7.6	7.7
23	7.8	7.8	7.6	7.7	8.1	7.5	7.8	8.1	7.7	7.7	7.6	7.7
24	7.8	7.8	7.6	7.6	12.9	7.5	7.8	8.0	7.7	7.7	7.6	7.7
25	7.8	7.8	7.6	7.6	8.8	7.5	7.8	7.9	8.2	7.6	7.6	7.7
26	7.8	7.8	7.6	7.6	9.0	7.5	7.8	7.9	7.9	7.6	7.7	7.7
27	7.8	7.8	7.6	7.6	9.3	7.4	7.8	7.9	7.8	7.6	7.7	7.7
28	7.8	7.8	7.5	7.6	8.7	7.4	7.8	7.8	7.8	7.6	7.8	7.7
29	7.8	.....	7.5	7.6	8.2	7.4	7.6	7.8	7.7	7.6	7.8	7.7
30	7.8	.....	7.5	7.6	7.5	7.4	7.6	7.8	7.7	7.6	7.8	7.7
31	7.8	.....	7.5	.....	7.5	.....	7.6	.....	.....	7.6	.....	7.7

LLANO RIVER.

Llano River drains the territory east of Sonora and northeast of Rocksprings and joins the Colorado about 20 miles southeast of the town of Llano. The South Llano is fed by large springs whose joint discharge has measured 90 second-feet at Junction at the minimum stage. In Kimble County alone on the South Llano there are some fifteen small irrigation plants, and at Junction an irrigation plant on a large scale has begun operations. Its plan is to take the water from the South Llano and irrigate several thousand acres near Junction.

The waters of the North Llano at low stages are utilized by small irrigation plants before they get to Junction. Between Junction and Llano, in dry times, the water is subject to great evaporation, and loses at least one-third before it reaches the upper part of Llano County.

A measurement taken at Hedwigs Hill on June 15, 1906, by S. P. Finch gave a total discharge of 65 second-feet. At the town of Llano the water is utilized in a power plant, which supports the city water supply and a small mill. A full description of this and other power plants on the Llano is given in Water-Supply Paper No. 105.

BARTONS SPRINGS NEAR AUSTIN, TEX.

These springs are located about 2 miles from Austin and are similar in behavior and in flow to the Comal, San Felipe, and San Marcos. They respond in flow to the rainfall in the Edwards Plateau, but this response is always delayed for some months. The variation in the flow of these springs is shown in the following table:

Discharge measurements of Bartons Springs near Austin, Tex., 1894–1906.

	Sec.-ft.		Sec.-ft.
1894	17	June, 1902	19
1895	25	August, 1902	19
March, 1898	20	June, 1903	69
May, 1898	30	June, 1904	43
August, 1900	69	July, 1905	65
December, 1900	33	June, 1906	24

GUADALUPE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Guadalupe River rises in the southern-central part of Texas, flows southeastward, and empties into San Antonio Bay. During the summer of 1902 its discharge was the least in its observed history, causing much loss above New Braunfels, where half a dozen power plants were forced to shut down or to run on short time. The flow at this time was so low that special efforts were made to obtain measurements at several points along its course.

The Guadalupe, while it is the best water-power stream in Texas, has a drainage area above Cuero of only 5,100 square miles. Its efficiency is due almost entirely to the water received from the Comal at New Braunfels. Below New Braunfels the largest tributary is San Marcos River.

GUADALUPE RIVER NEAR CUERO, TEX.

This station was established December 26, 1902. The original location was at the dam at Carl Buchel's power house, 3 miles north of Cuero, Tex. As it proved impossible to measure flood discharges at this point, a new station was established in July, 1903, at the bridge of the San Antonio and Aransas Pass Railroad 3 miles west of Cuero. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 31, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of Guadalupe River near Cuero, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.2	6.1	6.3	6.2	6.2	6.0	5.9	6.0	6.1	6.0	6.0	5.9
2	6.2	6.2	6.2	6.2	6.4	5.9	5.8	6.0	6.0	6.0	6.1	6.0
3	6.2	6.2	6.2	6.2	6.2	5.9	5.7	6.0	6.0	6.0	6.0	6.0
4	6.2	6.2	6.2	6.2	6.3	5.8	5.9	6.1	6.0	6.0	6.0	6.0
5	6.3	6.2	6.2	6.1	6.1	5.8	6.4	6.0	5.9	6.0	6.0	6.0
6	6.2	6.1	6.2	6.1	5.9	5.7	7.1	6.0	5.9	6.1	5.9	6.1
7	6.3	6.1	6.2	6.2	6.1	5.6	5.9	6.1	5.9	6.1	5.9	6.1
8	6.2	6.1	6.2	6.3	6.0	5.5	6.1	6.0	5.9	6.0	6.0	6.1
9	6.2	6.1	6.3	6.3	6.0	5.5	6.0	6.0	6.0	6.0	6.0	6.1
10	6.2	6.2	6.3	6.3	6.1	5.6	6.0	6.0	6.0	6.0	6.0	6.1
11	6.1	6.3	6.3	6.3	6.0	5.7	6.1	6.0	6.0	6.0	6.0	6.0
12	6.1	6.3	6.3	6.3	6.0	5.7	6.0	6.0	6.0	5.9	6.0	6.0
13	6.2	6.3	6.3	6.3	6.0	5.7	6.0	6.2	6.0	5.8	5.9	6.1
14	6.2	6.4	6.3	6.3	6.0	5.6	6.0	6.1	6.0	5.9	5.9	6.0
15	6.2	17.0	6.3	6.4	6.0	5.7	5.9	6.0	6.1	5.9	6.0	6.0

Daily gage height, in feet, of Guadalupe River near Cuero, Tex., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	6.2	11.1	6.2	6.8	6.0	5.6	6.1	6.0	6.1	6.0	5.9	6.0
17	6.3	9.8	6.3	6.4	6.0	5.6	6.0	6.0	6.1	6.0	6.0	6.0
18	6.3	8.0	6.2	6.4	6.0	5.5	6.1	6.0	6.0	6.0	6.0	6.1
19	6.2	7.6	6.1	6.3	6.1	5.5	6.0	6.1	6.4	6.0	6.0	6.1
20	6.3	7.0	6.2	6.5	6.0	5.4	6.1	6.0	6.4	6.0	6.0	6.1
21	6.2	6.8	6.2	7.1	5.8	5.5	6.2	6.1	6.4	6.0	6.0	6.1
22	6.2	6.5	6.2	6.7	5.7	5.6	6.0	6.1	6.3	6.1	5.9	6.1
23	6.2	6.4	6.2	6.5	5.8	5.6	6.0	6.0	6.3	6.0	5.8	6.1
24	6.2	6.2	6.2	6.3	5.9	5.5	6.1	6.0	6.3	5.9	6.0	6.1
25	6.3	6.3	6.2	6.2	6.8	5.5	6.0	6.1	6.3	6.0	5.9	6.1
26	6.3	6.3	6.3	6.1	7.8	7.0	6.0	6.2	6.2	6.0	5.9	6.1
27	6.3	6.3	6.3	6.1	8.4	7.0	5.9	6.1	6.2	6.0	5.9	6.2
28	6.2	6.3	6.3	6.0	6.9	6.8	6.0	6.1	6.1	5.9	6.0	6.2
29	6.2	.....	6.3	6.0	6.5	6.6	6.0	6.0	6.0	6.0	6.0	6.2
30	6.2	.....	6.3	6.4	6.2	6.5	6.0	6.1	6.0	6.0	6.0	6.1
31	6.2	.....	6.3	.....	6.2	.....	6.0	6.1	.....	6.0	.....	6.2

Rating table for Guadalupe River near Cuero, Tex., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.40	370	6.60	790	7.80	1,210	9.00	1,630	11.40	2,470
5.50	405	6.70	825	7.90	1,245	9.20	1,700	11.60	2,540
5.60	440	6.80	860	8.00	1,280	9.40	1,770	11.80	2,610
5.70	475	6.90	895	8.10	1,315	9.60	1,840	12.00	2,680
5.80	510	7.00	930	8.20	1,350	9.80	1,910	13.00	3,030
5.90	545	7.10	965	8.30	1,385	10.00	1,980	14.00	3,400
6.00	580	7.20	1,000	8.40	1,420	10.20	2,050	15.00	3,800
6.10	615	7.30	1,035	8.50	1,455	10.40	2,120	16.00	4,200
6.20	650	7.40	1,070	8.60	1,490	10.60	2,190	17.00	4,650
6.30	685	7.50	1,105	8.70	1,525	10.80	2,260		
6.40	720	7.60	1,140	8.80	1,560	11.00	2,330		
6.50	755	7.70	1,175	8.90	1,595	11.20	2,400		

NOTE.—The above table is based on one discharge measurement made during 1905 and measurements prior to 1904. It is well defined.

Monthly discharge of Guadalupe River near Cuero, Tex., for 1906.

[Drainage area, 5,100 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	685	615	656	40,300	0.129	0.15
February	4,650	615	968	53,800	.190	.20
March	685	615	666	41,000	.131	.15
April	965	580	691	41,100	.135	.15
May	1,420	475	664	40,800	.130	.15
June	930	370	520	30,900	.102	.11
July	965	475	595	36,600	.117	.13
August	650	580	597	36,700	.117	.13
September	720	545	614	36,500	.120	.13
October	615	510	575	35,400	.113	.13
November	615	510	568	33,800	.111	.12
December	650	545	606	37,300	.119	.14
The year	4,650	370	643	464,000	0.126	1.69

COMAL RIVER AT NEW BRAUNFELS, TEX.

Comal River has its source in the numerous big springs that issue from the foothills west of New Braunfels, Tex. The joint discharge of these forms Comal River at the junction of Comal Springs Creek and Comal Creek. The water from the head springs naturally flows down Comal Springs Creek, but a gravel dam deflects part of this flow into the Landa mill race, whose waters rejoin Comal Creek about 4 miles above the highway bridge north of the court-house. The following table shows the result of current-meter measurements on Comal River at various times:

Discharge measurements of Comal River at New Braunfels, Tex., 1895–1906.

Date.	Hydrographer.	Discharge.	Remarks.
		Sec.-ft.	
1895	C. C. Babb	328	At highway bridge.
1898	T. U. Taylor	320	Do.
1899	do	310	In park.
1900	do	374	Do.
1901	do	343	Do.
1902	do	333	Do.
1903	do	412	In park (recent rains).
1904	do	375	In park.
1905	do	390	Do.
1906	do	386	Do.

SAN MARCOS RIVER AT SAN MARCOS, TEX.

San Marcos River rises about 1 mile northeast of the town of San Marcos and flows into Guadalupe River near the town of Gonzales. Its source is in several large springs, now submerged by a lake created by the dam of the San Marcos Water Company. There are five power plants on the San Marcos within a distance of 6 miles of lake. Below the lake there are many irrigation plants, all of which derive their water from the river by means of pumps operated by water power or by engines.

The following discharge measurements have been made:

Discharge measurements on San Marcos River.

Year.	Hydrographer.	Discharge.	Locality.
		Sec.-ft.	
1894	C. C. Babb	150	International and Great Northern Railroad bridge.
1895	do	89	1 mile northeast of San Marcos.
1899	T. U. Taylor		
1900	do	150	Westerfield ford.
1903	do	153	Do.
1906	do	145	Do.

SAN ANTONIO RIVER DRAINAGE BASIN.

SAN ANTONIO RIVER AT SAN ANTONIO, TEX.

San Antonio River rises about 3 miles north of the mission of San Fernando, the geographic center of the city of San Antonio. San Pedro Creek rises in San Pedro Park and has maintained a flow of 9 second-feet for several years. It joins San Antonio River just below the city and above the Hot Wells, where many of the measurements are made.

San Antonio River has gone through the same experience as many of the big springs. About 1885 it began to fail, and by the latter part of 1897 had entirely ceased above the city. It regained its former efficiency in 1900, shortly after the celebrated flood (Water-Supply Paper No. 105), but in two years the discharge dropped again to a third of the discharge in 1900. There is no doubt that the river and the artesian wells have the same underground source. The following table shows the discharge measurements that have been made on this stream:

Discharge measurements of San Antonio River at San Antonio, Tex., 1895–1906.

Date.	Hydrographer.	Discharge.	Remarks.
		Sec.-ft.	
December, 1895	C. C. Babb	40	Upper canal.
November, 1896	do	41	Do.
December, 1897	T. U. Taylor	0	Lower canal.
December, 1897	do	11	Hot Wells.
March, 1898	do	0	Lower canal.
March, 1898	do	9	Hot Wells.
June, 1899	do	0	Lower canal.
June, 1899	do	10	Hot Wells.
September, 1900	do	103	Lower canal.
September, 1900	do	125	Hot Wells.
October, 1901	do	41	Do.
March, 1904	do	65	Do.
June, 1904	do	61	Do.
September, 1905	do	117	Do.
June, 1906	do	54	Do.

NUECES RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The main forks of Nueces River rise in the eastern part of Edwards County, Tex., and flow southward through the rugged mountains of the Edwards Plateau, uniting with the west fork about 14 miles from Uvalde and about 6 miles above the crossing of the Southern Pacific Railroad. The main fork is fed by springs and carries perpetually running water from its source, a few miles north of Vance, to its junction with the west fork at the foot of the Edwards Plateau. At about the junction of the branches the flow sinks into gravel beds, locally reappearing in big clear pools at points where the gravel has been washed off from the solid bed-rock bottom. Four or five

miles below the Southern Pacific Railroad bridge flowing water again appears, the stream along its lowland course being fed by numerous springs.

Near the post-office of Barksdale the main fork is joined by Pulliam Creek, which in dry times has a small discharge at its mouth, amounting to perhaps 5 second-feet.

The larger part of the discharge of the main fork below Barksdale comes from the prong by Vance. From Vance to the point where it debouches from the Edwards Plateau it is fed by many springs that rise in the banks or in the many abutting canyons. The largest of these is Camp Woods Spring, whose discharge on April 10, 1906, was found to be 3 second-feet.

The following discharge measurements were made on the Nueces and its tributaries in 1906:

Discharge measurements in Nueces River basin, 1906.

Date.	Stream.	Hydrographer.	Discharge.	Location.
			Sec.-ft.	
April 6	Nueces	T. U. Taylor	39	Laguna.
April 6	do	do	46	Shoe Peg Mountain.
April 6	do	do	24	Barksdale.
April 10	Camp Woods	do	3	Near Barksdale.

In Edwards County, in the watershed of the Nueces and its tributaries, there are fifteen small irrigation plants that derive their water directly from the river and its tributaries or from springs that issue from the foothills a short distance from the main stream. The water of the Nueces is of the best quality for irrigation and affords rich returns where the dam and farm are so located that the occasional torrential floods can not destroy them.

Below Barksdale other irrigation plants derive their water by ditch or pump from the Nueces. The Fern Lake Company has a tract of nearly 200 acres near Montell that is irrigated by ditch from the river itself, while a short distance below Montell the irrigation plant derives its water from Montell Creek. Still farther down the river J. J. Dodson has installed a modern pump-irrigation plant and is prepared to irrigate about 150 acres by pump irrigation.

The Nueces offers excellent opportunities for the installation of a big ditch irrigation system. Between Uvalde and the Dodson plant there are several thousand acres of rich land that could be brought to ditch by the construction of a dam across the Nueces.

Between the Southern Pacific Railroad and the International and Great Northern Railroad very few attempts have been made to use the water of the Nueces for irrigation purposes. At Cotulla many excellent irrigation plants have been installed, and Bermuda and other onions are successfully raised.

LEONA RIVER AT UVALDE, TEX.

The flow of Leona River is variable, and the river has often stopped flowing altogether near Uvalde. It was dry in 1885, but soon revived and continued flowing till 1893, when it again ceased for a time. Its history at the brickyard crossing, 1½ miles below the town on the road to Pearsall, is given in the following table:

Discharge measurements of Leona River at Uvalde, Tex., 1885–1906.

Date.	Hydrographer.	Discharge.	Remarks.
		Sec.-ft.	
1885			Flowed.
1893			Did not flow.
December, 1895	C. C. Babb	11	
June, 1899	T. U. Taylor		Do.
September, 1900	do	5	
March, 1904	do	22	
August, 1905	do	13	
April, 1906	do	7	

RIO GRANDE DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The source of the Rio Grande is in the snow masses of the high peaks of the continental divide in Hinsdale and Mineral counties in southwestern Colorado. The main stream flows in an easterly direction for about 75 miles, receiving numerous tributaries from the mountainous region through which it passes. At Del Norte the stream channel leaves a narrow canyon-like valley and enters the San Luis Valley. From Del Norte the general course is southeasterly for about 75 miles to a point 20 miles east of Antonito, where it crosses the Colorado-New Mexico State line. Four miles above the State line the river enters a canyon, locally known as Rio Grande canyon, and continues through it to a point a short distance below Embudo, N. Mex., where the canyon walls retreat rapidly, especially on the west side, giving room for a border of irregular hills between the higher mesa walls and the flood plain adjacent to the river. This is the beginning of Espanola Valley, about 3 or 4 miles in width, which extends about 25 miles to White Rock Canyon, through which the Rio Grande flows for 30 miles. Again the canyon walls recede, and the river enters Albuquerque Valley, which averages from 1 to 3 miles in width to about Socorro, N. Mex. Throughout its course in New Mexico the general direction of the Rio Grande is southward to El Paso; thence it is southeasterly to the Gulf of Mexico.

From the high mountains which surround this basin come a large number of small streams, some of which unite into creeks of considerable size, while others sink and gradually disappear into the coarse soil of the valley bottom. Below Del Norte few streams of importance enter the river with the exception of the Chama in New Mexico and

the Pecos in Texas, as nearly all those which issue from the mountains lose their water, except in flood periods, in the sandy plains before they reach the main channel. Rio Conchos is the principal tributary from the Mexican side.

The limited data on precipitation collected by the United States Weather Bureau show the mean annual rainfall to be 25 inches in the mountainous portion of the drainage. This diminishes to 10 inches in the foothills and lower portions of the drainage.

The determination of the amount of water in the Rio Grande is of importance, both on account of its use in irrigation and from its bearing upon interstate and international distribution of water. Most of the New Mexico and Texas stations down to Eagle Pass are maintained by the United States section of the International (Water) Boundary Commission. The data for the following stations have been collected by W. W. Follett, consulting engineer for the Commission, and have been furnished through the courtesy of Gen. Anson Mills, Commissioner.

Rio Grande near San Marcial, N. Mex.
Rio Grande near El Paso, Tex.
Rio Grande above Presidio, Tex.
Rio Grande below Presidio, Tex.
Rio Grande near Langtry, Tex.
Rio Grande at Eagle Pass, Tex.
Pecos River near Moorhead, Tex.
Devils River near Devils River Station, Tex. (two stations).

On account of the shifting character of the river beds at the International (Water) Boundary stations, no rating tables have been prepared. The estimated monthly discharges are from daily discharges computed by Mr. Follett directly from the discharge measurements.

The five stations from Laredo down (Laredo, Roma, Brownsville, Salado, near Guerrero, and San Juan at Santa Rosalie Ranch) are maintained by the Mexican section of the Commission.

RIO GRANDE PROPER.

RIO GRANDE NEAR DEL NORTE, COLO.

Measurements and observations were begun in the vicinity of Del Norte in 1889 by George T. Quinby, the object being to obtain the flow of the river before water was diverted for the agricultural region of San Luis Valley, and by comparison with the figures obtained at Embudo to acquire data as to the effect of the numerous ditches taking out water between the two points. The river 25 miles above Del Norte flows out of the canyon at Wagon Wheel Gap. Little water, however, is diverted until the edge of the San Luis Valley is reached, the largest canal heading near the town of Del Norte. During freshets the river divides into a number of channels, making it

difficult to obtain measurements near town. In order to avoid the expense of establishing a station during time of high water, the first measurements—those about June 1—were made from several bridges crossing the numerous branches. The results were not wholly satisfactory, and June 25 a station was established above the branches. Later a locality about 2 miles farther up was chosen. Records are continuous for a period of sixteen years.

The station is about 2 miles west of Del Norte, above the main canal taking water from the Rio Grande, and is above all the irrigating ditches of importance. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 36, where are given also references to publications that contain data for previous years.

Discharge measurements of Rio Grande near Del Norte, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 2	R. I. Meeker	130	156	1.15	383
April 29	do	144	332	2.42	1,470
May 24	Murphy & Meeker	163	718	4.90	5,000
June 13	R. I. Meeker	167	948	6.30	7,730
October 25	do	136	238	1.70	741

Daily gage height, in feet, of Rio Grande near Del Norte, Colo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.0	1.0	1.15	1.2	2.25	4.2	3.5		1.45	2.35	
2	1.0	1.0	1.1	1.15		4.5		2.1			1.75
3	1.0	1.0	1.1	1.2	2.1	4.4	3.3		1.45	2.3	
4	1.0	1.0	1.1	1.1		4.1		2.0			1.75
5	1.0	1.0	1.0	1.1	3.1	4.5	3.1		1.4	2.2	
6	1.0	1.0	1.0	1.2		5.25		1.95			1.65
7	1.0	1.0	1.05	1.3	3.5	5.35	2.9		1.2	2.0	
8	1.0	1.0	1.1	1.4		4.95		1.8			1.6
9	1.0	1.0	1.1	1.35	4.1	5.2	2.6		1.2	1.9	
10	1.0	1.0	1.1			5.7		1.7			1.55
11	1.0	1.15	1.0	1.6	4.35	6.0	2.9		1.15	1.8	
12	1.0	1.25	1.0			6.2		1.65			1.5
13	1.0	1.4	0.9	1.5	3.7	6.35	2.7		1.2	1.7	
14	1.0	1.5	1.0			6.15		1.7			1.5
15	1.0	1.6	1.0	1.75	3.45	6.0	3.05		1.6	1.7	
16	1.0	1.65	1.0			6.0		1.6			1.45
17	1.0	1.7	1.05	2.0	4.5	5.9	2.55		1.7	1.75	
18	1.0	1.7	0.9			5.4		1.6			1.4
19	1.0	1.75	1.0	2.3	5.4	4.9	2.4		1.7	1.7	
20	1.0	1.8	1.05			4.6		1.6			1.2
21	1.0	1.7	1.0	2.5	5.9	4.4	2.3		1.65	1.65	
22	1.0	1.7	1.1			4.3		1.6			1.2
23	1.0	1.7	1.1	3.2	5.7	4.3	2.35		1.6	1.7	
24	1.0	1.6	1.1		4.9	4.15		1.65			1.05
25	1.0	1.4	1.1	3.1	4.3	3.7	2.85		1.65	1.7	
26	1.0	1.4	1.1		3.9	3.55		1.6			1.0
27	1.0	1.4	1.1	2.7	4.1	3.5	2.75		2.5	1.75	
28	1.0	1.3	1.1		4.3	3.45		1.6			1.0
29	1.0	1.2	1.1	2.45	4.3	3.35	2.7		2.4	1.7	
30	1.0		1.0		4.15	3.45		1.5			1.05
31	1.0		1.1		4.05		2.25			1.75	

Rating table for Rio Grande near Del Norte, Colo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	280	1.80	840	2.70	1,795	3.60	3,000	5.00	5,260
1.00	320	1.90	930	2.80	1,920	3.70	3,150	5.20	5,600
1.10	365	2.00	1,025	2.90	2,050	3.80	3,300	5.40	5,960
1.20	415	2.10	1,120	3.00	2,180	3.90	3,460	5.60	6,320
1.30	470	2.20	1,220	3.10	2,310	4.00	3,620	5.80	6,680
1.40	530	2.30	1,325	3.20	2,440	4.20	3,940	6.00	7,040
1.50	600	2.40	1,435	3.30	2,580	4.40	4,260	6.20	7,400
1.60	675	2.50	1,550	3.40	2,720	4.60	4,580	6.40	7,760
1.70	755	2.60	1,670	3.50	2,860	4.80	4,920		

NOTE.—The above table is applicable only for open-channel conditions. It is based on five discharge measurements made during 1906 and is well defined.

Monthly discharge of Rio Grande near Del Norte, Colo., for 1906.

[Drainage area, 1,400 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	320	320	320	19,700	.229	.26
February	840	320	521	28,900	.372	.39
March	390	280	344	21,200	.246	.28
April	2,440	365	1,090	64,900	.779	.87
May	6,860	1,120	3,830	236,000	2.74	3.16
June	7,670	2,650	4,970	296,000	3.55	3.96
July	2,860	1,270	1,880	116,000	1.34	1.54
August	1,200	582	775	47,700	.554	.64
September	1,550	390	719	42,800	.514	.57
October	1,380	715	891	54,800	.636	.73
November	798	320	546	32,500	.390	.44
The period				960,000		

NOTE.—Values are rated as excellent.

RIO GRANDE NEAR LOBATOS, COLO.

This station was established June 28, 1899, at the State highway bridge at a point near the Colorado-New Mexico State line, about 10 miles east of Lobatos post-office and in T. 33 N., R. 11 E., and 13 miles east of Antonio, the nearest railroad station. The record of flow is of importance because of the proposed Government irrigation project near Engle, N. Mex., and also because it gives the discharge of the river at the Colorado State line, and includes practically all of the Colorado drainage. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 39, where are given also references to publications that contain data for previous years.

Discharge measurements of Rio Grande near Lobatos, Colo., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 21	R. I. Meeker	234	433	2.45	801
June 23	do	249	1,030	4.25	3,340
July 26[a]	do	207	188	1.12	67
September 22	do	200	166	1.00	46
1906.					
May 1	do	239	564	2.80	1,260
May 23	do	259	1,430	5.80	6,220
June 14	do	259	1,620	6.50	7,740
October 26	do	211	506	2.60	1,000

[a] Made by wading.

Daily gage height, in feet, of Rio Grande near Lobatos, Colo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	2.2	2.4	2.6	1.5	2.85	3.85	2.9	2.85	1.6	3.0	2.7
2	2.2	2.4	2.6	1.5	2.65	3.65	2.8	2.7	1.6	3.0	2.7
3	2.2	2.4	2.6	1.4	2.6	4.0	2.9	2.6	1.6	2.9	2.8
4	2.2	3.0	2.6	1.4	2.7	4.0	2.9	2.55	1.6	2.8	2.75
5	2.2	3.0	2.3	1.4	2.7	4.0	2.9	2.5	1.6	2.75	2.7
6	2.2	3.0	2.3	1.4	3.1	4.15	3.0	2.4	1.6	2.7	2.7
7	2.2	3.0	2.0	1.4	3.45	4.55	3.0	2.4	1.6	2.6	2.6
8	2.2	3.0	1.8	1.4	3.6	4.85	3.0	2.3	1.6	2.6	2.6
9	2.2	3.0	1.8	1.4	4.05	4.9	3.0	2.25	1.6	2.55	2.6
10	2.2	3.0	1.8	1.4	4.25	4.95	3.1	2.2	1.6	2.55	2.6
11	2.2	2.95	1.8	1.4	4.55	5.15	3.2	2.15	1.6	2.4	2.5
12	2.2	2.9	1.8	1.75	4.7	5.45	3.2	2.1	1.6	2.35	2.5
13	2.3	2.9	1.8	1.9	4.6	5.9	3.2	2.1	1.6	2.25	2.5
14	2.3	2.9	1.8	1.8	4.3	6.4	3.3	2.0	1.6	2.15	2.5
15	2.3	2.8	1.8	1.7	4.0	6.65	3.3	2.0	1.6	2.1	2.5
16	2.3	2.8	1.8	1.75	3.9	6.7	3.4	1.9	1.6	2.1	2.5
17	2.3	2.8	1.8	1.8	3.9	6.75	3.45	1.85	1.6	2.1	2.55
18	2.3	2.8	1.8	1.9	3.9	6.55	3.3	1.75	1.7	2.1	2.6
19	2.4	2.8	1.8	2.05	4.3	6.3	3.2	1.65	1.85	2.1	2.65
20	2.4	2.8	1.8	2.25	4.8	5.85	3.1	1.6	1.85	2.1	2.4
21	2.4	2.8	1.8	2.45	5.2	5.15	2.95	1.55	1.9	2.25	2.3
22	2.4	2.8	1.8	2.65	5.3	4.55	2.8	1.5	1.9	2.35	2.3
23	2.4	2.8	1.8	2.95	5.55	4.3	2.7	1.5	2.0	2.45	2.3
24	2.4	2.8	1.8	3.45	6.0	4.05	2.6	1.6	2.05	2.5	2.3
25	2.4	2.8	1.8	3.7	5.85	3.85	2.6	1.6	2.15	2.6	.....
26	2.4	2.6	1.8	3.7	5.45	3.6	2.6	1.6	2.35	2.6	.....
27	2.4	2.6	1.8	3.55	5.45	3.25	2.7	1.6	2.4	2.7	.....
28	2.4	2.6	1.8	3.35	4.0	3.05	2.7	1.6	2.5	2.7	.....
29	2.4	.....	1.8	3.15	3.9	2.9	3.0	1.6	2.8	2.7	.....
30	2.4	.....	1.75	3.0	3.85	2.9	3.1	1.6	3.0	2.75	.....
31	2.4	.....	1.6	.....	3.9	.....	3.0	1.6	.....	2.7	.....

Rating table for Rio Grande near Lobatos, Colo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	45	2.00	475	3.00	1,470	4.00	2,900	6.00	6,700
1.10	65	2.10	550	3.10	1,590	4.20	3,240	6.20	7,120
1.20	90	2.20	630	3.20	1,710	4.40	3,590	6.40	7,540
1.30	120	2.30	715	3.30	1,840	4.60	3,950	6.60	7,960
1.40	155	2.40	805	3.40	1,980	4.80	4,320	6.80	8,380
1.50	195	2.50	900	3.50	2,120	5.00	4,700	7.00	8,800
1.60	240	2.60	1,000	3.60	2,270	5.20	5,080	8.00	10,900
1.70	290	2.70	1,110	3.70	2,420	5.40	5,470	9.00	13,000
1.80	345	2.80	1,230	3.80	2,580	5.60	5,870		
1.90	405	2.90	1,350	3.90	2,740	5.80	6,280		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905–6 and is well defined between gage heights 1.0 foot and 6.5 feet.

Monthly discharge of Rio Grande near Lobatos, Colo., for 1905–6.

[Drainage area, 7,700 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
1905.						
January	1,000	1,000	1,000	61,500	0.130	0.15
February	1,290	1,170	1,230	68,300	.160	.17
March	1,710	475	898	55,200	.117	.13
April	1,840	405	773	46,000	.100	.11
May	11,700	1,840	5,690	350,000	.739	.85
June	13,100	1,470	7,220	430,000	.938	1.05
July	1,350	90	272	16,700	.035	.04
August	290	90	163	10,000	.021	.02
September	90	45	64.4	3,830	.0084	.01
October	195	45	102	6,270	.013	.02
November	405	120	229	13,600	.030	.03
December	630	405	546	33,600	.071	.08
The year	13,100	45	1,520	1,100,000	.197	2.66
1906.						
January	805	630	720	44,300	.094	.11
February	1,470	805	1,240	68,900	.161	.17
March	1,000	240	453	27,900	.059	.07
April	2,420	155	761	45,300	.099	.11
May	6,700	1,000	3,330	205,000	.432	.50
June	8,280	1,350	4,370	260,000	.568	.63
July	2,050	1,000	1,470	90,400	.191	.22
August	1,290	195	503	30,900	.065	.07
September	1,470	240	423	25,200	.055	.06
October	1,470	550	923	56,800	.120	.14
November 1–24	1,230	715	954	45,400	.124	.11
The period				900,000		

NOTE.—Values are rated as follows: May and June, 1905, and May to July, 1906, excellent; remaining months 1905–6, good.

RIO GRANDE NEAR SAN MARCIAL, N. MEX.

August 8, 1889, a station was established near San Marcial and a measurement was made which gave a discharge of 19 second-feet. Soon after this date, however, the river gage was destroyed and the locality abandoned until January 29, 1895, when the station was reestablished at the bridge of the Atchison, Topeka and Santa Fe Railway, 1 mile south of San Marcial, N. Mex. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 43, where are given also references to publications that contain data for previous years.

Discharge measurements of Rio Grande near San Marcial, N. Mex., in 1906.

[By George W. King and D. H. Armstrong.]

Date.	Area of section.	Gage height.	Discharge.	Date.	Area of section.	Gage height.	Discharge.
	Sq. ft.	*Feet.*	*Sec.-ft.*		*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 2	106	6.5	125	June 29	629	8.4	2,811
January 5	148	7.0	282	July 2	447	7.9	1,713
January 8	131	6.8	241	July 5	550	8.5	2,314
January 11	164	7.2	283	July 8	684	8.8	2,722
January 14	198	7.2	514	July 11	529	8.4	2,188
January 17	468	7.9	1,249	July 14	494	8.4	1,926
January 20	486	7.9	1,312	July 17	525	8.5	2,271
January 23	305	7.1	613	July 20	605	8.9	3,010
January 26	296	7.2	487	July 23	414	8.2	1,667
January 29	327	7.4	803	July 26	292	8.0	1,170
January 31	250	7.1	648	July 29	236	7.9	1,074
February 3	241	7.3	623	July 31	319	8.4	1,429
February 6	252	7.5	703	August 3	309	8.3	1,470
February 9	246	7.4	633	August 6	365	8.5	1,360
February 12	268	7.7	794	August 9	289	8.3	1,094
February 15	286	7.8	874	August 12	170	7.9	627
February 18	238	7.6	778	August 15	141	7.7	526
February 21	365	7.7	721	August 18	107	7.6	422
February 24	296	7.6	658	August 21	112	7.6	222
February 27	355	7.6	779	August 24	83	7.3	156
March 3	246	7.4	678	August 27	115	7.7	295
March 6	270	7.6	692	August 30	98	7.5	184
March 9	256	7.5	579	September 2	94	7.5	174
March 12	289	7.6	751	September 5	52	7.0	70
March 15	342	7.8	980	September 8	31	6.7	41
March 18	391	7.9	1,030	September 11	18	6.2	10
March 21	287	7.8	785	September 25	23	6.4	13
March 24	203	7.7	516	September 28	1,035	9.3	4,434
March 27	319	7.9	742	September 30	386	7.5	1,149
March 30	578	8.5	2,204	October 3	365	7.5	1,234
April 3	282	7.7	1,207	October 6	329	7.7	1,382
April 6	501	8.0	1,445	October 9	285	7.8	1,177
April 9	344	8.1	1,432	October 12	250	7.7	909
April 12	365	8.2	1,727	October 15	252	7.7	1,001
April 15	537	8.7	2,142	October 18	273	7.8	877
April 18	467	8.5	2,660	October 22	292	7.9	1,077
April 21	808	9.3	3,423	October 25	322	8.1	1,387
April 24	805	9.5	4,382	October 28	342	8.2	1,070
April 27	1,354	9.8	5,691	October 31	329	8.3	1,405
April 30	1,194	9.5	5,256	November 3	414	8.5	1,550
May 3	927	9.0	4,149	November 6	349	8.4	1,617
May 6	965	9.0	4,395	November 9	453	8.5	1,546
May 9	1,410	10.0	7,381	November 12	340	8.5	1,486
May 12	1,893	10.4	9,075	November 15	298	8.5	1,423
May 15	2,126	10.3	10,448	November 20	303	8.4	1,235
May 18	1,845	10.1	9,649	November 26	249	8.0	898
May 20	1,827	10.4	8,951	November 29	304	8.1	1,015
May 22	1,796	10.9	10,799	December 2	388	8.5	1,386
May 25	1,861	10.8	10,157	December 5	364	8.5	1,730
May 28	1,523	10.6	9,211	December 8	435	8.7	1,892
May 31	1,487	9.55	6,513	December 11	401	8.5	1,553
June 3	1,198	9.1	5,316	December 14	331	8.4	1,405
June 7	1,063	9.3	5,297	December 17	290	8.4	1,193
June 10	1,080	9.4	5,435	December 20	194	7.9	731
June 13	1,095	9.8	6,115	December 23	187	8.0	687
June 16	1,425	10.3	8,353	December 26	331	8.3	966
June 19	1,579	10.7	8,476	December 29	225	8.2	966
June 23	1,225	9.7	6,346	December 31	273	8.4	1,114

Daily gage height, in feet, of Rio Grande near San Marcial, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.5	7.35	7.55	7.8	9.4	9.35	8.0	8.75	7.45	7.4	8.3	8.6
2	6.5	7.45	7.5	7.5	9.6	9.2	7.9	8.5	7.5	7.3	8.4	8.5
3	6.6	7.3	7.45	7.7	9.2	9.1	8.0	8.3	7.25	7.55	8.5	8.4
4	6.7	7.3	7.4	7.85	9.1	9.25	8.3	8.4	7.05	7.7	8.4	8.45
5	7.0	7.3	7.45	8.0	8.95	9.1	8.5	8.5	7.0	7.7	8.5	8.55
6	7.0	7.5	7.6	8.0	9.0	9.15	8.35	8.5	6.8	7.7	8.4	9.1
7	6.9	7.3	7.65	7.95	9.5	9.3	8.5	8.3	6.7	7.85	8.4	9.35
8	6.8	7.35	7.55	8.0	9.9	9.3	8.7	8.3	6.7	7.85	8.45	8.85
9	6.8	7.4	7.5	8.1	9.9	9.3	8.6	8.3	6.55	7.8	8.5	8.6
10	7.0	7.5	7.5	7.95	10.1	9.4	8.55	8.2	6.35	7.8	8.4	8.5
11	7.2	7.55	7.6	8.05	10.2	9.45	8.4	8.2	6.2	7.75	8.5	8.5
12	7.0	7.7	7.6	8.2	10.5	9.65	8.35	7.9	5.95	7.7	8.5	8.4
13	7.1	7.7	7.45	8.15	10.55	9.85	8.4	7.85	.....	7.7	8.5	8.5
14	7.2	7.8	7.55	8.25	10.45	9.95	8.4	7.8	.....	7.7	8.5	8.4
15	7.4	7.8	7.75	8.55	10.3	10.3	8.4	7.7	.....	7.7	8.5	8.4
16	7.65	7.75	7.8	8.55	10.1	10.35	8.5	7.95	.....	7.75	8.5	8.5
17	7.9	7.7	7.75	8.45	10.1	10.45	8.4	7.9	.....	7.9	8.5	8.4
18	7.95	7.6	7.9	8.5	10.1	10.6	8.45	7.6	.....	7.8	8.5	8.15
19	8.0	7.55	8.0	8.65	10.1	10.65	8.5	7.7	.....	7.8	8.4	8.1
20	7.9	7.6	7.9	8.8	10.4	10.4	8.7	7.6	.....	7.8	8.45	7.95
21	7.7	7.7	7.8	9.2	10.7	10.1	8.55	7.6	.....	7.85	8.4	7.9
22	7.5	7.55	7.75	9.45	10.9	9.95	8.4	7.6	.....	7.9	8.25	8.0
23	7.2	7.6	7.8	9.45	10.9	9.65	8.25	7.5	.....	8.0	8.0	8.0
24	7.1	7.6	7.7	9.5	10.8	9.3	8.2	7.3	.....	8.0	7.9	8.15
25	7.2	7.55	7.8	9.55	10.8	9.1	8.1	7.05	6.4	8.1	8.0	8.3
26	7.2	7.5	7.9	9.95	10.75	9.0	8.0	7.5	6.75	8.1	8.0	8.3
27	7.1	7.6	7.9	9.85	10.6	8.75	8.0	7.75	6.95	8.2	8.1	8.25
28	7.2	7.5	8.55	9.55	10.5	8.45	7.9	7.7	10.4	8.2	8.05	8.25
29	7.4	.....	8.6	9.3	10.0	8.35	7.9	7.65	7.85	8.3	8.1	8.2
30	7.3	.....	8.5	9.4	9.8	8.15	8.2	7.5	7.45	8.4	8.2	8.3
31	7.1	.....	8.2	.....	9.5	.....	8.4	7.55	.....	8.3	.....	8.4

NOTE.—No flow September 13 to 24 inclusive.

Daily discharge, in second-feet, of Rio Grande near San Marcial, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	155	715	790	1,260	4,970	5,980	1,950	1,940	170	1,110	1,410	1,480
2	[a] 125	720	760	1,110	5,380	5,590	[a] 1,710	1,675	[a] 175	1,070	1,480	[a] 1,390
3	155	[a] 625	[a] 730	[a] 1,210	[a] 4,560	[a] 5,320	1,810	[a] 1,470	125	[a] 1,270	[a] 1,550	1,420
4	185	625	620	1,330	4,430	5,560	2,110	1,480	80	1,380	1,520	1,560
5	[a] 280	625	610	1,450	4,210	5,060	[a] 2,310	1,490	[a] 70	1,380	1,650	[a] 1,770
6	280	[a] 705	[a] 690	[a] 1,450	[a] 4,390	5,050	2,110	[a] 1,360	50	[a] 1,380	[a] 1,620	3,500
7	260	615	750	1,380	5,890	[a] 5,300	2,310	1,095	40	1,410	1,570	4,500
8	[a] 240	625	630	1,390	7,080	5,300	[a] 2,580	1,095	[a] 40	1,310	1,560	2,120
9	240	[a] 635	[a] 580	[a] 1,430	[a] 7,080	5,300	2,450	[a] 1,095	30	[a] 1,180	[a] 1,550	1,750
10	260	685	580	1,380	7,800	5,430	2,390	975	20	1,110	1,450	1,600
11	[a] 285	710	750	1,530	8,230	5,520	[a] 2,190	975	[a] 10	1,010	1,510	[a] 1,550
12	300	[a] 795	[a] 750	[a] 1,730	[a] 9,370	5,860	2,030	[a] 625	5	[a] 910	[a] 1,490	1,450
13	405	795	580	1,690	10,080	[a] 6,240	2,010	600	0	940	1,470	1,510
14	[a] 515	875	700	1,770	10,340	6,820	[a] 1,930	575	0	970	1,450	[a] 1,400
15	720	[a] 875	920	[a] 2,020	[a] 10,450	8,020	1,990	[a] 525	0	[a] 1,000	[a] 1,420	1,330
16	980	850	980	2,250	9,780	[a] 8,500	2,210	660	0	970	1,400	1,340
17	1,250	825	920	2,400	9,710	8,440	[a] 2,110	615	0	1,020	1,380	[a] 1,190
18	1,320	[a] 780	[a] 1,030	[a] 2,660	[a] 9,650	8,530	2,180	[a] 420	0	[a] 880	1,360	960
19	1,390	710	1,110	2,800	8,850	[a] 8,330	2,270	405	0	910	1,250	915
20	[a] 1,310	700	950	2,940	[a] 8,950	7,840	[a] 2,640	290	0	940	[a] 1,280	[a] 780
21	1,130	[a] 720	[a] 790	[a] 3,320	10,060	7,200	2,340	[a] 220	0	1,010	1,240	690
22	950	630	680	3,910	[a] 10,800	6,880	2,050	220	0	[a] 1,080	1,110	730
23	[a] 700	660	690	4,100	10,700	[a] 6,200	[a] 1,760	200	0	1,210	900	[a] 685
24	560	[a] 660	[a] 520	[a] 4,380	10,250	5,150	1,610	[a] 155	0	1,250	720	825
25	540	670	630	4,670	[a] 10,160	4,590	1,390	105	[a] 15	[a] 1,390	900	968
26	[a] 485	680	740	6,000	9,890	4,330	[a] 1,170	240	50	1,250	[a] 900	[a] 965
27	525	[a] 780	[a] 740	5,840	9,330	3,680	1,170	[a] 320	70	1,210	990	955
28	645	720	2,330	5,190	[a] 8,910	2,930	[a] 1,070	295	9,070	[a] 1,070	960	980
29	[a] 805	.....	2,450	4,690	7,630	[a] 2,710	1,070	270	1,790	1,250	[a] 1,010	[a] 965
30	755	.....	[a] 2,200	4,970	7,130	2,310	[a] 1,280	[a] 185	[a] 1,060	1,430	1,100	1,040
31	[a] 650	.....	1,470	.....	[a] 6,380	.....	1,450	210	.....	[a] 1,410	.....	[a] 1,115

[a] Dates of measurements.

Monthly discharge of Rio Grande near San Marcial, N. Mex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	1,390	125	594	36,496
February	875	615	715	39,689
March	2,450	520	925	56,866
April	6,000	1,110	2,742	163,140
May	10,800	4,210	8,143	500,707
June	8,530	2,310	5,799	345,064
July	2,640	1,070	1,924	118,314
August	1,940	105	703	43,210
September	9,070	0	429	25,527
October	1,430	880	1,152	70,830
November	1,650	720	1,307	77,752
December	4,500	685	1,401	86,142
The year	10,800	0	2,153	1,563,737

RIO GRANDE NEAR EL PASO, TEX.

This station was located at the pumping house of the smelter company, 3 miles north of El Paso, Tex. The bed of the stream at that point is composed of mud and is constantly shifting and changing. May 1, 1897, the station was placed under the charge of W. W. Follett, consulting engineer, International (Water) Boundary Commission, and by him removed 1 mile farther up the river to Courchesne's limekiln. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 49, where are given also references to publications that contain data for previous years.

Discharge measurements of Rio Grande near El Paso, Tex., in 1906.

[By W. L. Follett and J. Smith.]

Date.	Area of section.	Gage height.	Discharge.	Date.	Area of section.	Gage height.	Discharge.
	Sq. ft.	*Feet.*	*Sec.-ft.*		*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 1	179	6.2	235	April 2	552	8.2	1,283
January 4	140	5.95	163	April 5	426	7.5	752
January 7	144	6.0	176	April 8	457	7.75	936
January 10	147	6.0	177	April 11	396	7.5	742
January 13	172	6.3	240	April 14	528	8.2	1,146
January 16	173	6.3	242	April 17	649	8.55	1,468
January 18	292	7.25	553	April 20	534	8.05	1,168
January 21	425	7.45	844	April 23	690	8.7	1,706
January 24	458	7.65	977	April 26	727	8.8	1,865
January 27	349	7.05	559	April 28	884	9.5	2,855
January 30	328	7.0	516	April 30	1,094	10.0	3,475
February 2	312	7.0	526	May 3	1,076	9.8	3,696
February 5	264	6.9	435	May 6	853	9.3	2,760
February 8	291	7.0	496	May 9	808	9.55	2,909
February 11	334	7.3	597	May 12	1,325	10.6	4,832
February 14	371	7.4	717	May 15	1,245	11.45	5,901
February 17	411	7.6	823	May 18	1,581	11.95	7,329
February 20	345	7.3	634	May 20	1,368	11.55	6,388
February 23	327	7.2	555	May 23	1,428	11.8	7,135
February 26	315	7.1	517	May 26	1,460	12.3	8,312
March 2	308	7.0	515	May 29	1,447	12.45	8,140
March 5	274	6.9	427	June 1	1,032	11.25	5,848
March 8	246	6.9	394	June 4	946	10.55	4,473
March 11	255	6.9	403	June 7	998	10.0	4,357
March 14	191	6.7	270	June 10	815	10.0	3,701
March 17	185	6.8	280	June 13	768	10.25	3,733
March 20	298	7.25	553	June 16	1,062	11.0	4,843
March 23	287	7.1	497	June 19	1,161	11.5	5,875
March 26	233	6.8	355	June 22	1,207	11.85	6,500
March 29	189	6.6	237	June 25	821	10.95	4,801
March 31	452	8.05	1,100	June 28	626	9.9	3,069

Discharge measurements of Rio Grande near El Paso, Tex., in 1906—Continued.

Date.	Area of section.	Gage height.	Discharge.	Date.	Area of section.	Gage height.	Discharge.
	Sq. ft.	*Feet.*	*Sec.-ft.*		*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 30	534	9.3	2,126	October 1	419	8.3	1,155
July 3	518	8.75	1,450	October 3	216	7.3	579
July 6	449	8.65	1,334	October 6	216	7.15	464
July 9	663	9.0	1,938	October 9	317	7.45	650
July 12	827	9.4	2,682	October 12	290	7.4	685
July 15	598	8.7	1,586	October 15	225	7.15	542
July 18	631	8.85	1,771	October 18	214	7.05	506
July 21	527	8.8	1,686	October 21	228	7.15	528
July 24	434	8.8	1,509	October 24	218	7.1	526
July 27	320	8.1	1,056	October 27	263	7.6	849
July 29	308	8.0	995	October 30	208	7.1	493
July 31	268	7.9	678	November 2	247	7.4	758
August 3	448	8.6	1,328	November 5	331	7.85	1,178
August 6	441	8.6	1,513	November 8	411	8.1	1,136
August 9	324	8.0	1,144	November 11	435	8.1	1,243
August 12	361	8.0	747	November 14	334	8.1	1,150
August 15	332	7.7	504	November 18	303	7.9	1,011
August 18	167	7.0	393	November 21	302	8.1	1,106
August 21	140	6.8	291	November 24	349	8.0	1,013
August 24	139	6.6	251	November 27	223	7.6	545
August 27	77	6.0	122	November 29	221	7.6	638
August 30	211	7.35	577	December 2	316	8.1	999
September 2	100	6.3	160	December 5	792	10.35	3,899
September 5	42	5.75	63	December 8	338	8.45	1,507
September 8	28	5.4	37	December 11	414	8.5	1,565
September 11	16	5.1	18	December 14	282	8.3	1,106
September 14	16	5.0	19	December 17	330	8.25	1,212
September 17	9	4.95	10	December 20	373	8.0	1,166
September 20	8	4.95	8	December 23	290	7.5	775
September 24	8	5.0	7	December 26	288	7.2	598
September 27	11	4.8	12	December 29	351	7.75	942
September 30	97	6.0	156	December 31	342	7.8	812

Daily gage height, in feet, of Rio Grande near El Paso, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.15	6.9	7.0	8.4	10.0	11.4	9.1	8.0	6.5	8.45	7.4	8.05
2	6.05	6.95	7.0	8.25	9.8	10.95	8.9	8.2	6.25	7.6	7.4	8.1
3	6.0	7.0	7.0	8.05	9.8	10.7	8.7	8.7	6.05	7.3	7.6	8.1
4	5.95	7.0	7.0	8.2	9.65	10.55	8.4	9.35	5.9	7.3	7.9	8.2
5	5.9	6.95	6.9	8.1	9.45	10.45	8.55	9.8	5.75	7.15	7.85	10.2
6	6.0	7.0	6.85	7.5	9.3	10.3	8.6	8.7	5.65	7.1	7.85	9.6
7	6.0	7.05	6.85	7.5	9.35	10.0	8.55	8.4	5.6	7.3	7.9	8.7
8	6.0	6.95	6.9	7.8	9.3	9.85	8.9	8.1	5.45	7.4	8.1	8.45
9	6.0	6.95	7.25	7.7	9.5	9.9	9.05	8.25	5.4	7.45	8.2	8.85
10	6.0	7.2	7.05	7.6	9.95	9.95	9.1	8.6	5.3	7.5	8.15	8.8
11	6.15	7.3	6.85	7.55	10.35	10.0	9.2	8.55	5.15	7.5	8.1	8.5
12	6.2	7.25	6.7	7.6	10.55	10.15	9.35	8.05	5.1	7.4	8.1	8.4
13	6.3	7.2	6.7	8.05	10.6	10.25	9.2	7.95	5.1	7.4	8.1	8.3
14	6.3	7.4	6.7	8.2	11.0	10.65	8.85	7.9	5.05	7.3	8.1	8.3
15	6.3	7.4	6.7	8.05	11.4	10.8	8.75	7.7	5.0	7.15	8.0	8.3
16	6.3	7.4	6.7	8.3	11.7	10.95	8.65	7.4	5.0	7.2	7.95	8.2
17	6.3	7.55	6.8	8.55	11.9	11.2	8.75	7.15	4.95	7.15	7.85	8.2
18	7.2	7.5	6.7	8.35	11.95	11.35	8.85	6.9	4.95	7.05	7.95	8.1
19	7.15	7.45	7.2	8.1	11.65	11.45	9.15	6.65	4.95	7.0	8.0	8.0
20	7.35	7.3	7.3	8.05	11.55	11.55	8.75	6.9	4.95	6.95	8.1	8.0
21	7.6	7.3	7.25	8.2	11.6	11.65	8.9	6.7	4.95	7.05	8.1	7.8
22	7.85	7.2	7.3	8.6	11.65	11.85	8.8	6.8	4.9	6.8	8.05	7.8
23	7.8	7.2	7.15	8.7	11.75	11.45	8.9	7.4	5.15	6.9	7.9	7.55
24	7.75	7.1	6.95	8.9	12.05	11.3	8.8	6.55	5.1	7.0	7.95	7.35
25	7.5	7.1	6.8	8.8	12.2	10.9	8.4	6.45	5.0	7.3	8.0	7.3
26	7.35	7.05	6.8	8.8	12.35	10.6	8.2	6.2	4.9	7.35	7.8	7.2
27	7.05	7.1	6.7	9.2	12.5	10.2	8.1	6.0	4.85	7.55	7.6	7.3
28	7.0	7.0	6.7	9.5	12.5	9.8	8.1	6.05	4.85	7.6	7.4	7.25
29	7.0	.....	6.6	9.9	12.45	9.5	8.0	7.1	5.8	7.5	7.5	7.75
30	7.0	.....	6.65	10.0	12.4	9.35	7.95	7.25	5.9	7.2	7.8	7.7
31	6.95	.....	7.5	.....	11.9	.....	7.9	6.8	.....	7.25	.....	7.8

Daily discharge, in second-feet, of Rio Grande near El Paso, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	[a] 220	455	485	1,520	3,680	[a] 6,120	1,880	775	260	[a] 1,245	760	960
2	190	[a] 490	[a] 515	[a] 1,340	3,480	5,260	1,630	960	[a] 150	755	[a] 760	[a] 1,000
3	175	515	515	1,170	[a] 3,700	4,770	[a] 1,390	[a] 1,430	115	[a] 580	950	1,000
4	[a] 165	510	515	1,280	3,420	[a] 4,470	1,040	2,400	90	580	1,220	1,080
5	150	[a] 470	[a] 425	[a] 1,210	3,040	4,580	1,220	3,080	[a] 65	465	[a] 1,180	[a] 3,670
6	175	500	385	750	[a] 2,760	4,600	[a] 1,280	[a] 1,610	55	[a] 435	1,100	2,770
7	[a] 175	530	375	750	2,740	[a] 4,360	1,160	1,390	50	555	1,060	1,740
8	175	[a] 470	[a] 395	[a] 970	2,520	3,880	1,760	1,200	40	620	[a] 1,140	[a] 1,510
9	175	440	610	900	[a] 2,810	3,740	[a] 2,030	[a] 1,230	35	[a] 650	1,250	2,070
10	[a] 175	565	490	820	3,640	[a] 3,610	2,120	1,440	30	700	1,250	1,990
11	210	[a] 595	[a] 370	[a] 780	4,370	3,560	2,310	1,380	[a] 20	720	[a] 1,240	[a] 1,560
12	220	585	290	800	[a] 4,740	3,690	[a] 2,590	[a] 805	20	[a] 685	1,210	1,380
13	[a] 240	575	280	1,060	4,830	[a] 3,730	2,370	705	25	685	1,180	1,200
14	240	[a] 715	[a] 270	1,150	5,330	4,320	1,740	665	[a] 20	630	[a] 1,150	[a] 1,110
15	240	715	270	1,060	[a] 5,840	4,550	1,660	[a] 505	20	[a] 540	1,080	1,150
16	[a] 240	715	270	1,260	6,610	[a] 4,770	1,520	455	15	560	1,040	1,120
17	240	[a] 795	[a] 280	[a] 1,470	7,190	5,250	1,650	415	[a] 10	540	970	[a] 1,170
18	[a] 520	760	270	1,350	[a] 7,330	5,560	[a] 1,770	[a] 355	10	[a] 505	[a] 1,030	1,140
19	540	730	520	1,200	6,630	[a] 5,770	2,280	245	10	495	1,060	1,110
20	730	[a] 635	[a] 580	[a] 1,170	[a] 6,390	5,960	1,600	340	[a] 10	485	1,110	[a] 1,170
21	[a] 945	630	555	1,290	6,540	6,140	[a] 1,840	[a] 250	10	[a] 505	[a] 1,110	1,010
22	1,110	560	580	1,630	6,690	[a] 6,500	1,630	290	10	425	1,060	930
23	1,080	[a] 555	[a] 520	[a] 1,710	[a] 6,990	5,740	1,720	530	20	460	960	[a] 810
24	[a] 1,045	500	425	1,930	7,730	5,450	[a] 1,510	[a] 240	[a] 15	490	[a] 980	685
25	870	510	355	1,850	8,080	[a] 4,720	1,250	220	10	655	970	655
26	765	[a] 485	[a] 355	[a] 1,870	[a] 8,460	4,220	1,120	165	10	690	760	[a] 600
27	[a] 560	515	295	2,430	8,700	3,560	[a] 1,060	[a] 120	[a] 15	[a] 820	[a] 550	660
28	525	455	295	[a] 2,850	8,490	[a] 2,910	1,060	130	15	850	470	630
29	520	.....	[a] 235	3,350	[a] 8,140	2,440	[a] 990	495	125	780	[a] 550	[a] 940
30	[a] 515	.....	265	[a] 3,470	8,040	[a] 2,210	830	[a] 545	[a] 140	[a] 565	760	815
31	480	.....	[a] 770	.....	7,040	.....	[a] 680	410	.....	585	.....	810

[a] Dates of measurements.

Monthly discharge of Rio Grande near El Paso, Tex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	1,110	150	439	26,995
February	795	440	571	31,686
March	770	235	412	25,309
April	3,470	750	1,480	88,046
May	8,700	2,520	5,676	348,992
June	6,500	2,210	4,548	270,625
July	2,590	680	1,571	96,575
August	3,080	120	799	49,150
September	260	10	47	2,817
October	850	425	621	38,192
November	1,250	470	997	59,326
December	3,670	600	1,240	76,255
The year	8,700	10	1,533	1,113,968

RIO GRANDE ABOVE PRESIDIO, TEX.

This station was established April 4, 1900, by the International (Water) Boundary Commission. It was 9 miles above Presidio and above the mouth of Rio Conchos, one of the principal tributaries of the Rio Grande, and about 200 miles below El Paso. The station was in a straight stretch of the river, but in the bight of a long bend. In 1903 the river began to erode a cut-off across this bend, and the spring flood of 1905 deepened this channel to such an extent that

more water passed through it than through the station, and it became necessary to abandon the location. In September, 1905, the station was moved 8 miles farther upstream and rebuilt. Its location is far enough above the mouth of Rio Conchos to be free from the effects of backwater from that stream. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 54, where are given also references to publications that contain data for previous years.

Discharge measurements of Rio Grande above Presidio, Tex., in 1906.

[By James P. Hague and F. X. Dougherty.]

Date.	Area of section.	Gage height.	Discharge.	Date.	Area of section.	Gage height.	Discharge.
	Sq. ft.	*Feet.*	*Sec.-ft.*		*Sq. ft.*	*Feet.*	*Sec.-ft*
January 3	171	3.9	423	July 11	324	4.5	718
January 6	165	3.8	398	July 14	387	5.1	1,169
January 10	129	3.6	286	July 17	367	4.9	995
January 14	107	3.4	236	July 20	395	5.1	1,136
January 17	130	3.35	223	July 23	327	4.6	850
January 20	124	3.3	206	July 26	301	4.35	695
January 24	163	3.75	364	July 29	287	4.3	651
January 28	225	4.3	597	August 1	265	4.3	616
January 31	231	4.45	660	August 4	277	4.4	645
February 3	241	4.2	505	August 7	395	5.2	1,213
February 6	214	4.1	437	August 10	470	5.4	1,527
February 9	215	4.1	426	August 13	377	5.0	943
February 13	224	4.2	530	August 16	350	4.6	827
February 16	237	4.3	586	August 19	205	4.2	441
February 19	214	4.2	538	August 22	168	3.9	348
February 22	229	4.15	504	August 25	265	4.35	639
February 25	230	4.3	510	August 28	410	4.9	1,178
March 4	196	4.1	434	August 31	224	3.8	411
March 11	187	4.1	437	September 3	158	3.7	337
March 16	176	3.95	338	September 6	138	3.6	296
March 19	172	3.9	321	September 9	112	3.3	201
March 22	155	3.8	280	September 12	95	3.1	143
March 25	152	3.7	239	September 15	91	3.0	123
March 28	163	3.8	278	September 18	81	2.9	86
March 31	171	3.9	347	September 21	118	3.3	186
April 3	171	3.9	269	September 24	94	3.0	126
April 6	255	4.3	583	September 27	64	2.8	75
April 9	288	4.4	685	September 30	55	2.6	56
April 12	228	4.2	484	October 3	53	2.6	59
April 15	210	4.1	480	October 6	38	2.4	36
April 18	256	4.2	557	October 9	134	3.65	317
April 21	302	4.5	738	October 12	112	3.5	241
April 24	296	4.5	779	October 15	175	4.0	428
April 27	337	4.8	1,047	October 18	151	3.7	364
April 30	432	5.1	1,278	October 21	136	3.6	327
May 3	848	6.2	2,676	October 24	154	3.6	322
May 6	716	6.1	2,394	October 27	139	3.5	291
May 9	549	5.7	2,051	October 30	118	3.5	287
May 12	521	5.6	1,908	November 2	199	3.9	528
May 15	840	6.3	3,045	November 5	157	3.8	408
May 18	972	6.7	3,675	November 8	178	3.9	487
May 21	1,263	7.2	4,978	November 11	251	4.3	680
May 24	1,298	7.2	5,105	November 14	329	4.6	1,002
May 27	1,320	7.3	5,688	November 17	262	4.4	812
May 30	1,357	7.4	5,946	November 19	238	4.3	692
June 2	1,613	7.75	7,294	November 23	260	4.35	724
June 5	1,183	7.3	5,854	November 26	272	4.4	780
June 8	864	6.5	3,994	November 29	237	4.3	671
June 11	766	6.2	3,203	December 2	204	3.9	464
June 14	698	6.1	2,935	December 5	337	4.5	966
June 17	767	6.25	3,380	December 8	382	4.6	1,103
June 20	811	6.65	3,722	December 11	437	5.4	1,576
June 23	968	7.2	4,998	December 14	392	5.3	1,431
June 26	1,262	7.5	6,334	December 17	346	5.0	1,057
June 29	854	6.95	4,178	December 20	308	4.8	904
July 2	585	6.05	2,248	December 23	301	4.7	863
July 5	526	5.5	1,734	December 26	260	4.5	696
July 8	367	4.6	878	December 29	223	4.3	547

Daily gage height, in feet, of Rio Grande above Presidio, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.0	4.55	4.1	3.85	5.4	7.65	6.3	4.3	3.75	2.6	3.8	4.1
2	4.0	4.3	4.2	3.9	5.8	7.7	6.05	4.25	4.5	2.6	3.85	3.95
3	3.95	4.2	4.15	3.85	6.15	7.8	6.7	4.35	3.85	2.6	3.9	3.8
4	3.85	4.15	4.15	3.85	6.2	7.6	5.65	4.4	4.05	2.55	3.8	3.85
5	3.8	4.15	4.1	3.8	6.15	7.25	6.05	5.9	3.65	2.5	3.8	4.35
6	3.8	4.15	4.1	4.25	6.1	7.1	6.35	4.7	3.6	2.45	3.8	4.5
7	3.8	4.05	4.15	4.5	6.0	6.8	5.6	5.3	3.45	2.4	3.8	4.55
8	3.8	4.1	4.05	4.5	5.9	6.5	4.6	5.8	3.45	3.6	4.05	4.55
9	3.7	4.15	4.1	4.4	5.75	6.35	4.5	5.8	3.35	3.65	4.3	6.0
10	3.65	4.2	4.1	4.35	5.6	6.25	4.55	5.55	3.25	3.5	4.3	5.8
11	3.6	4.15	4.05	4.35	5.6	6.2	4.75	5.5	3.2	3.4	4.3	5.35
12	3.55	4.25	3.95	4.25	5.6	6.2	6.25	5.0	3.15	3.5	4.35	5.45
13	3.5	4.25	3.95	4.25	5.8	6.15	5.35	5.25	3.1	3.65	4.55	5.6
14	3.45	4.25	3.95	4.15	6.1	6.15	5.2	5.15	3.1	3.7	4.6	5.35
15	3.4	4.2	3.95	4.05	6.35	6.2	5.05	4.95	3.0	4.0	4.5	5.35
16	3.45	4.3	3.95	4.1	6.4	6.25	4.95	4.55	3.3	3.8	4.4	5.2
17	3.35	4.3	3.9	4.1	6.55	6.25	4.95	4.55	3.0	3.7	4.35	5.05
18	3.35	4.3	3.9	4.2	6.75	6.4	5.65	4.45	2.9	3.7	4.25	4.9
19	3.4	4.2	3.9	4.45	6.95	6.6	5.2	4.3	2.95	3.6	4.25	4.8
20	3.35	4.2	3.85	4.45	7.15	6.65	5.2	4.2	3.15	3.6	4.45	4.8
21	3.35	4.15	3.8	4.5	7.2	6.75	5.0	4.0	3.2	3.55	4.35	4.8
22	3.45	4.15	3.75	4.7	7.3	6.95	4.95	3.85	3.1	3.55	4.35	4.8
23	3.5	4.3	3.7	4.6	7.3	7.15	4.65	3.95	3.0	3.65	4.35	4.7
24	3.7	4.3	3.7	4.5	7.2	7.35	4.5	3.9	3.0	3.6	4.5	4.75
25	3.8	4.25	3.7	4.45	7.2	7.4	4.3	4.2	3.2	3.5	4.45	4.6
26	3.9	4.25	3.75	4.55	7.2	7.5	4.35	4.1	2.9	3.5	4.45	4.55
27	4.1	4.2	3.8	4.85	7.25	7.55	4.15	6.4	2.8	3.55	4.4	4.5
28	4.3	4.15	3.8	5.15	7.45	7.25	4.4	4.65	2.75	3.5	4.35	4.4
29	4.45	.....	3.95	5.15	7.45	7.05	4.35	4.15	2.7	3.55	4.35	4.35
30	4.55	.....	3.95	5.1	7.4	6.6	4.3	4.1	2.65	3.5	4.3	4.3
31	4.45	.....	3.95	.....	7.35	.....	4.25	3.8	.....	3.45	.....	4.25

Daily discharge, in second-feet, of Rio Grande above Presidio, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	480	715	435	300	1,660	7,070	2,780	[a] 615	375	55	470	570
2	470	565	475	295	2,170	[a] 7,280	[a] 2,250	600	930	60	[a] 500	490
3	[a] 445	505	455	250	[a] 2,610	7,680	3,550	630	[a] 450	[a] 60	520	410
4	410	475	[a] 455	250	2,640	6,950	1,860	[a] 645	545	50	420	450
5	400	470	435	230	2,510	[a] 5,730	[a] 2,280	2,190	325	45	[a] 410	[a] 850
6	[a] 400	[a] 465	435	[a] 545	[a] 2,390	5,400	2,880	860	[a] 295	[a] 40	410	965
7	390	405	455	785	2,310	4,700	1,780	[a] 1,370	250	35	410	1,035
8	380	425	415	785	2,220	[a] 4,000	[a] 880	2,150	250	295	560	[a] 1,035
9	330	[a] 450	435	[a] 685	[a] 2,090	3,610	770	2,150	[a] 215	[a] 315	680	2,500
10	[a] 305	490	435	635	1,910	3,340	790	[a] 1,760	185	260	680	2,190
11	285	480	[a] 415	635	1,910	[a] 3,200	[a] 920	1,670	170	220	680	[a] 1,530
12	270	540	365	[a] 535	[a] 1,910	3,200	2,650	940	[a] 155	[a] 240	[a] 730	1,610
13	260	[a] 555	355	540	2,230	3,070	1,420	[a] 1,190	145	295	950	1,750
14	[a] 245	555	350	495	2,720	[a] 3,070	[a] 1,270	1,090	145	315	1,000	[a] 1,480
15	235	530	345	440	[a] 3,120	3,230	1,130	925	[a] 125	[a] 430	[a] 900	1,460
16	245	[a] 585	[a] 340	480	3,200	[a] 3,380	1,040	[a] 775	210	385	810	1,280
17	[a] 225	585	320	480	3,440	[a] 3,380	[a] 1,040	775	115	365	750	[a] 1,110
18	225	585	320	[a] 555	[a] 3,810	3,510	1,740	680	[a] 85	[a] 365	630	980
19	240	[a] 540	[a] 320	705	4,330	3,680	1,250	[a] 535	95	325	630	905
20	[a] 225	535	300	705	4,850	[a] 3,720	[a] 1,250	440	145	325	[a] 840	[a] 905
21	225	510	280	[a] 740	[a] 4,980	3,950	1,080	380	[a] 160	[a] 310	740	905
22	260	[a] 505	[a] 260	915	5,280	4,410	1,050	[a] 335	145	310	730	865
23	275	555	240	850	5,320	[a] 4,890	880	380	125	340	720	905
24	[a] 345	530	240	[a] 780	[a] 5,100	5,590	790	350	[a] 125	[a] 320	[a] 870	780
25	385	[a] 490	[a] 240	740	5,210	5,890	665	[a] 540	175	290	820	[a] 735
26	430	490	260	825	5,320	[a] 6,330	[a] 695	580	100	290	820	695
27	515	470	280	[a] 1,090	5,560	6,310	520	3,580	[a] 75	[a] 305	[a] 780	620
28	[a] 595	450	[a] 280	1,320	6,080	5,240	740	[a] 1,000	70	290	720	[a] 585
29	660	.....	345	1,320	6,080	[a] 4,480	[a] 695	650	65	305	720	545
30	700	.....	355	[a] 1,280	[a] 5,950	3,410	665	615	[a] 60	[a] 285	[a] 670	510
31	[a] 660	.....	[a] 365	.....	5,820	.....	635	[a] 410	.....	270	.....	.....

[a] Dates of meter measurements.

Monthly discharge of Rio Grande above Presidio, Tex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	700	225	371	22,840
February	715	405	516	28,671
March	475	240	355	21,828
April	1,320	230	673	40,046
May	6,080	1,660	3,701	227,564
June	7,680	3,070	4,657	277,091
July	3,550	520	1,353	83,197
August	3,580	335	994	61,111
September	930	60	210	12,516
October	430	35	251	15,461
November	1,000	410	686	40,800
December	2,500	410	1,018	62,588
The year	7,680	35	1,232	893,713

RIO GRANDE BELOW PRESIDIO, TEX.

This station was established April 8, 1900, by the International (Water) Boundary Commission. It is 6 miles below Presidio, and is also below the mouth of Rio Conchos, and about 215 miles below El Paso. It is at the west end of the canyon section of the Rio Grande. The discharge at this station minus the discharge at the station above Presidio, Tex., is the discharge of Rio Conchos, except at rare intervals, when some rain water enters the Rio Grande from the north. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 58, where are given also references to publications that contain data for previous years.

Discharge measurements of Rio Grande below Presidio, Tex., in 1906.

[By James P. Hague and F. X. Dougherty.]

Date.	Area of section.	Gage height.	Discharge.	Date.	Area of section.	Gage height.	Discharge.
	Sq. ft.	*Feet.*	*Sec.-ft.*		*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 2	1,116	7.75	2,730	April 10	655	6.6	1,042
January 5	1,033	7.45	2,225	April 13	613	6.4	940
January 9	978	7.3	1,838	April 16	576	6.2	774
January 13	964	7.3	1,800	April 19	654	6.7	1,006
January 16	873	7.0	1,580	April 22	720	7.0	1,223
January 19	849	7.0	1,583	April 25	652	6.7	1,032
January 22	813	6.9	1,436	April 28	770	7.2	1,572
January 26	783	6.8	1,326	May 1	850	7.45	1,867
January 29	839	7.1	1,580	May 4	966	8.2	2,725
February 2	775	6.9	1,410	May 7	843	8.2	2,792
February 5	881	7.85	2,845	May 10	781	8.0	2,205
February 8	951	8.4	4,423	May 13	898	8.25	3,026
February 11	1,118	8.9	5,750	May 16	1,045	8.4	3,657
February 14	1,021	8.55	4,760	May 19	1,213	8.7	4,367
February 17	1,118	9.0	5,834	May 22	1,130	9.0	4,759
February 20	1,215	8.9	5,776	May 25	1,145	9.2	5,039
February 23	1,261	8.75	5,163	May 28	1,134	9.35	5,802
March 3	1,065	7.8	2,904	May 31	1,227	9.5	6,339
March 7	942	7.6	2,274	June 3	1,270	9.7	6,831
March 10	915	7.3	1,984	June 6	1,093	9.3	5,415
March 14	756	7.0	1,611	June 9	872	8.8	4,084
March 17	739	7.0	1,647	June 12	782	8.6	3,491
March 20	648	6.6	1,207	June 15	770	8.6	3,417
March 23	607	6.35	891	June 18	864	9.0	4,248
March 26	581	6.3	842	June 21	922	9.1	4,668
March 29	600	6.35	899	June 24	987	9.5	5,189
April 1	572	6.2	779	June 27	1,083	9.7	5,716
April 4	499	6.0	635	June 30	1,013	9.5	5,235
April 7	715	7.0	1,169	July 3	864	9.05	4,505

Discharge measurements of Rio Grande below Presidio, Tex., in 1906—Continued.

Date.	Area of section.	Gage height.	Discharge.	Date.	Area of section.	Gage height.	Discharge.
	Sq. ft.	*Feet.*	*Sec.-ft.*		*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 6	1,162	10.1	6,491	October 4	1,303	8.1	2,719
July 9	1,676	11.0	9,921	October 7	1,198	7.65	2,337
July 12	1,415	9.9	7,872	October 10	1,515	8.6	4,604
July 15	1,527	10.45	8,892	October 13	1,186	7.6	1,694
July 18	2,975	13.45	17,568	October 16	1,203	7.6	1,643
July 21	2,585	11.9	14,468	October 19	1,180	7.6	1,711
July 24	2,787	13.0	16,062	October 22	1,107	7.4	1,300
July 27	2,872	12.85	16,802	October 26	1,150	7.5	1,283
July 30	1,982	10.4	10,849	October 28	1,151	7.5	1,284
August 2	2,439	11.55	13,920	October 31	1,150	7.45	1,252
August 5	2,737	13.15	16,023	November 3	1,138	7.5	1,317
August 8	3,150	13.4	18,709	November 7	1,135	7.5	1,329
August 11	2,874	12.95	16,828	November 9	1,127	7.5	1,303
August 14	2,325	11.2	13,372	November 12	1,164	7.6	1,596
August 17	2,436	11.4	13,663	November 15	1,151	7.7	1,680
August 20	2,286	10.9	12,700	November 18	1,118	7.55	1,434
August 23	2,381	11.75	13,815	November 21	1,119	7.6	1,477
August 26	2,706	13.3	16,000	November 24	1,167	7.65	1,598
August 29	4,833	14.85	[a]25,887	November 28	1,097	7.6	1,483
September 1	2,598	12.5	15,386	November 30	1,098	7.6	1,485
September 4	2,502	11.9	14,489	December 3	962	7.4	1,147
September 7	2,274	10.25	11,966	December 6	1,062	7.6	1,448
September 10	1,980	9.4	7,441	December 9	1,092	8.2	2,578
September 14	1,815	9.0	6,439	December 12	1,062	7.95	2,279
September 16	1,740	8.6	4,720	December 15	1,012	7.9	2,094
September 19	1,800	8.8	5,861	December 18	977	7.8	1,889
September 22	1,580	8.25	3,067	December 21	958	7.7	1,789
September 25	1,652	8.75	5,079	December 24	934	7.7	1,724
September 28	1,783	8.8	5,646	December 27	852	7.6	1,347
October 1	1,490	8.5	4,428	December 30	800	7.5	1,171

[a] Includes overflow section.

Daily gage height, in feet, of Rio Grande below Presidio, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	8.0	7.3	8.0	6.2	7.45	9.6	9.35	10.65	12.7	8.5	7.45	7.55
2	7.8	6.9	7.9	6.15	7.8	9.55	9.25	11.55	13.05	8.2	7.45	7.5
3	7.65	6.85	7.8	6.1	8.15	9.6	9.35	11.55	12.55	8.2	7.45	7.45
4	7.6	7.35	7.85	6.05	8.25	9.6	9.1	11.9	11.85	8.15	7.4	7.4
5	7.45	7.85	7.75	6.05	8.75	9.45	9.45	13.1	11.55	8.0	7.45	7.55
6	7.4	8.15	7.7	7.45	9.25	9.2	10.0	13.5	11.4	7.9	7.5	7.6
7	7.4	8.4	7.6	7.2	8.55	8.95	8.45	14.2	10.75	7.7	7.5	7.7
8	7.4	8.45	7.45	6.95	8.15	8.85	11.45	13.65	9.95	7.7	7.5	7.65
9	7.3	8.7	7.35	6.85	8.05	8.8	11.4	15.15	9.6	8.05	7.55	8.15
10	7.3	9.3	7.25	6.65	7.95	8.8	11.05	14.4	9.4	8.65	7.6	8.15
11	7.3	9.05	7.2	6.45	7.85	8.7	10.3	13.35	9.35	8.0	7.6	8.0
12	7.3	9.05	7.1	6.4	7.8	8.6	9.9	13.75	9.2	7.6	7.6	7.95
13	7.25	8.85	7.1	6.45	8.25	8.55	10.55	12.5	9.15	7.6	7.7	8.0
14	7.15	8.6	7.0	6.45	8.25	8.55	10.4	11.2	9.05	7.8	7.7	8.0
15	7.05	8.55	7.0	6.45	8.3	8.6	10.6	14.3	8.85	7.85	7.7	7.95
16	7.0	8.75	6.95	6.25	8.4	8.6	12.4	13.65	8.6	7.7	7.65	7.95
17	7.0	9.0	6.95	6.4	8.45	9.1	13.0	11.5	9.0	7.75	7.6	7.85
18	7.0	9.05	6.75	6.7	8.45	9.05	13.25	11.7	9.2	7.65	7.55	7.8
19	7.0	8.8	6.65	6.7	8.75	9.05	12.55	11.5	9.55	7.6	7.6	7.8
20	7.0	8.9	6.55	6.75	8.9	9.2	12.9	11.1	9.3	7.6	7.6	7.8
21	7.0	9.45	6.5	6.7	9.1	9.15	11.95	11.05	8.45	7.6	7.6	7.75
22	6.95	9.15	6.45	7.0	9.1	9.25	11.25	11.4	8.25	7.5	7.6	7.7
23	6.9	8.8	6.35	7.0	9.1	9.45	12.8	11.75	9.15	7.55	7.6	7.7
24	6.9	8.85	6.3	6.85	9.2	9.5	13.05	12.4	9.25	7.5	7.65	7.7
25	6.8	8.65	3.3	6.75	9.25	9.55	13.9	12.9	8.95	7.5	7.65	7.7
26	6.8	8.45	6.3	6.75	9.4	9.75	14.25	14.15	8.85	7.5	7.6	7.65
27	6.85	8.25	6.3	7.1	9.4	9.75	12.95	16.4	8.45	7.5	7.6	7.6
28	7.05	8.1	6.35	7.25	9.35	9.7	10.85	16.5	8.85	7.45	7.6	7.55
29	7.2	.....	6.35	7.35	9.5	9.55	10.5	14.9	8.5	7.45	7.6	7.5
30	7.05	.....	6.3	7.25	9.5	9.45	10.4	14.4	8.75	7.5	7.6	7.5
31	7.05	.....	6.25	.....	9.5	.....	10.55	13.85	.....	7.45	.....	7.5

Daily discharge, in second-feet, of Rio Grande below Presidio, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,450	2,010	3,280	[a] 780	[a] 1,870	6,590	4,970	11,480	[a] 16,080	[a] 4,430	1,250	1,400
2	[a] 2,890	[a] 1,410	3,090	745	2,270	6,460	4,810	13,920	[a] 17,310	3,150	1,250	1,310
3	2,560	1,340	2,900	710	2,670	[a] 6,590	[a] 4,970	13,020	16,080	3,150	[a] 1,250	[a] 1,230
4	2,470	2,090	2,900	[a] 670	[a] 2,820	6,480	4,600	13,170	[a] 14,410	[a] 2,930	1,180	1,150
5	[a] 2,220	2,850	2,670	670	3,850	5,950	5,260	[a] 15,870	13,950	2,630	1,250	1,370
6	2,100	3,710	2,510	1,620	4,870	[a] 5,150	[a] 6,300	17,970	13,720	2,550	1,320	[a] 1,450
7	2,080	4,420	[a] 2,270	[a] 1,370	[a] 3,490	4,480	3,520	21,340	[a] 12,730	[a] 2,380	[a] 1,330	1,640
8	2,060	[a] 4,550	2,120	1,155	2,630	4,220	[a] 11,000	[a] 19,700	10,420	2,460	1,320	1,540
9	[a] 1,840	5,210	2,020	1,125	2,370	[a] 4,080	[a] 10,880	26,980	8,740	3,290	[a] 1,380	[a] 2,480
10	1,830	6,790	[a] 1,920	[a] 1,060	[a] 2,090	4,080	10,010	23,230	[a] 7,440	[a] 4,720	1,500	2,520
11	1,820	[a] 6,140	1,860	965	1,920	3,780	8,610	[a] 18,500	7,320	2,860	1,550	2,340
12	1,810	6,140	1,740	940	1,880	[a] 3,490	[a] 7,870	20,030	6,940	1,690	[a] 1,600	[a] 2,280
13	[a] 1,760	5,610	1,730	[a] 970	[a] 3,030	3,340	9,080	16,770	6,820	[a] 1,690	1,686	2,310
14	1,690	[a] 4,900	[a] 1,610	970	3,120	3,320	8,800	[a] 13,370	[a] 6,570	2,180	1,680	2,270
15	1,620	4,760	1,620	970	3,330	[a] 3,420	[a] 9,320	22,670	5,800	2,280	[a] 1,680	[a] 2,160
16	[a] 1,580	5,240	1,580	[a] 810	[a] 3,660	3,420	14,530	20,650	[a] 4,720	[a] 1,890	1,590	2,140
17	1,580	[a] 5,830	[a] 1,590	865	3,770	4,460	16,260	[a] 13,970	6,080	2,040	1,510	1,980
18	1,580	6,030	1,370	1,005	3,770	[a] 4,350	[a] 16,980	14,570	6,760	1,810	[a] 1,430	[a] 1,890
19	[a] 1,580	5,430	1,260	[a] 1,005	[a] 4,490	4,430	15,770	14,100	[a] 8,010	[a] 1,710	1,480	1,890
20	1,580	[a] 5,780	[a] 1,150	1,040	4,750	4,870	16,470	[a] 13,170	7,060	1,710	1,480	1,890
21	1,580	7,190	1,090	1,005	5,130	[a] 4,800	[a] 14,570	12,900	3,830	1,710	[a] 1,480	[a] 1,840
22	[a] 1,520	6,310	[a] 1,020	[a] 1,220	[a] 5,010	4,880	13,520	13,350	[a] 3,070	[a] 1,500	1,490	1,770
23	1,440	[a] 5,290	890	1,220	4,930	5,230	15,770	[a] 13,810	6,090	1,550	1,510	1,740
24	1,440	5,420	840	1,120	5,120	[a] 5,190	[a] 16,210	14,730	6,470	1,390	[a] 1,600	[a] 1,720
25	1,330	4,900	840	[a] 1,060	[a] 5,180	5,320	19,160	15,440	[a] 5,630	1,340	1,590	1,640
26	[a] 1,330	4,380	[a] 840	1,060	5,710	5,850	20,400	[a] 18,550	5,520	[a] 1,280	1,500	1,490
27	1,370	3,860	840	1,460	5,830	[a] 5,720	[a] 17,100	36,700	4,460	1,280	1,490	[a] 1,350
28	1,540	3,470	900	[a] 1,620	[a] 5,800	5,720	11,940	37,400	[a] 5,800	[a] 1,250	[a] 1,480	1,260
29	[a] 1,670	.....	[a] 900	1,720	6,280	[a] 5,360	11,090	[a] 26,240	4,750	1,250	1,480	1,180
30	1,540	.....	860	1,620	6,310	5,120	[a] 10,850	23,190	5,500	1,280	[a] 1,490	[a] 1,170
31	1,540	.....	820	.....	[a] 6,340	.....	11,210	20,440	.....	[a] 1,250	.....	1,170

[a] Dates of measurements.

Monthly discharge of Rio Grande below Presidio, Tex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	3,450	1,330	1,819	111,868
February	6,790	1,340	4,681	259,954
March	3,280	820	1,646	101,217
April	1,720	670	1,085	64,562
May	6,340	1,880	4,009	246,526
June	6,590	3,320	4,872	289,884
July	20,400	3,520	11,349	697,845
August	37,400	11,480	18,620	1,144,919
September	17,310	3,070	8,269	492,059
October	4,720	1,250	2,149	132,159
November	1,680	1,180	1,461	86,916
December	2,520	1,150	1,728	106,255
The year	37,400	670	5,141	3,734.164

RIO GRANDE NEAR LANGTRY, TEX.

This station was established in April, 1900, by the International (Water) Boundary Commission. It is located one-half mile south of Langtry station, on the Southern Pacific Railroad, and is about 440 miles below El Paso, Tex., at the east end of the canyon section of the Rio Grande, and a short distance to the west of the mouth of Pecos River, one of the principal tributaries of the Rio Grande. The con-

ditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 63, where are given also references to publications that contain data for previous years.

Discharge measurements of Rio Grande near Langtry, Tex., in 1906.

[By E. E. Winter.]

Date.	Area of section.	Gage height.	Discharge.	Date.	Area of section.	Gage height.	Discharge.
	Sq. ft.	*Feet.*	*Sec.-ft.*		*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 5	847	2.1	2,804	July 11	1,732	5.65	8,253
January 9	771	1.8	2,406	July 14	1,454	4.8	6,406
January 13	714	1.6	2,222	July 17	1,376	4.65	5,876
January 17	669	1.4	2,031	July 20	2,703	9.0	17,815
January 22	621	1.2	1,614	July 25	2,571	8.55	17,200
January 25	600	1.2	1,580	July 29	3,780	12.3	29,261
January 29	574	1.1	1,489	August 2	1,728	5.1	8,362
February 2	664	1.3	1,817	August 8	3,821	12.7	29,087
February 7	650	1.3	1,766	August 12	5,386	16.5	43,637
February 12	1,085	2.9	4,282	August 14	3,463	11.5	25,516
February 17	1,098	2.9	3,867	August 17	2,515	8.3	16,640
February 22	1,368	3.9	6,053	August 21	1,742	5.45	9,722
February 26	1,269	3.3	4,911	August 25	2,767	9.3	18,726
March 2	987	2.6	3,299	August 30	4,625	15.35	35,002
March 7	896	2.0	2,855	September 3	3,266	10.45	22,588
March 12	757	1.6	2,185	September 7	2,098	7.0	11,790
March 16	672	1.3	1,843	September 11	1,427	4.7	6,683
March 21	605	1.0	1,473	September 17	1,151	3.5	4,771
March 25	580	0.9	1,410	September 20	1,061	3.0	3,783
March 28	556	0.8	1,301	September 25	1,088	3.0	3,907
April 7	565	0.7	1,356	September 28	1,091	3.1	4,246
April 11	629	1.1	1,619	October 2	1,190	3.1	4,107
April 15	573	0.7	1,311	October 6	1,123	3.0	3,949
April 19	588	0.75	1,335	October 10	901	2.4	2,772
April 23	585	0.7	1,242	October 15	846	2.3	2,608
April 27	593	0.95	1,488	October 18	903	2.4	2,454
May 2	646	1.2	1,746	October 22	830	2.0	2,191
May 7	815	1.95	2,851	October 25	744	1.9	2,015
May 10	801	1.9	2,771	October 28	703	1.85	1,907
May 14	828	1.9	2,839	November 2	776	1.7	1,862
May 19	985	2.7	3,440	November 7	759	1.7	1,837
May 23	1,045	2.85	4,110	November 10	747	1.7	1,849
May 28	1,110	3.1	4,271	November 15	747	1.7	1,850
June 2	1,270	3.4	6,130	November 19	818	1.9	2,193
June 7	1,237	3.4	6,016	November 23	800	1.85	2,111
June 11	1,055	2.9	3,945	November 28	810	1.95	2,095
June 15	916	2.4	2,991	December 2	863	1.9	2,169
June 20	920	2.3	2,952	December 6	838	1.8	2,029
June 23	1,057	2.7	3,474	December 10	797	1.75	1,860
June 28	1,083	3.0	3,875	December 14	965	2.3	2,757
July 1	1,077	2.9	3,731	December 17	918	2.3	2,592
July 9	1,302	3.95	4,788	December 29	855	1.9	2,240

Daily gage height, in feet, of Rio Grande near Langtry, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.5	1.3	2.7	0.65	1.2	3.3	2.85	5.45	13.3	3.1	1.7	2.2
2	2.3	1.3	2.6	0.65	1.3	3.4	2.65	5.05	11.6	3.25	1.7	1.9
3	2.2	1.3	2.55	0.7	1.4	3.65	2.5	5.1	10.25	3.55	1.7	1.9
4	2.15	1.3	2.35	0.7	1.75	5.25	2.35	6.2	9.15	3.15	1.7	1.9
5	2.05	1.3	2.2	0.7	1.9	3.5	2.2	7.7	8.5	3.05	1.7	1.8
6	2.0	1.3	2.05	0.7	1.75	3.45	2.65	8.55	7.4	2.95	1.7	1.8
7	1.95	1.3	2.0	0.7	1.95	3.3	2.6	10.95	7.0	2.85	1.7	1.75
8	1.9	1.3	1.9	0.7	1.9	3.1	3.0	12.8	6.5	2.7	1.7	1.75
9	1.8	1.5	1.9	0.7	1.9	3.15	3.85	14.3	6.1	2.55	1.7	1.7
10	1.7	1.55	1.8	1.55	1.9	2.9	3.75	15.45	5.35	2.4	1.7	1.75
11	1.65	2.0	1.7	1.05	1.9	2.85	5.75	19.5	4.6	2.4	1.7	1.95
12	1.6	2.85	1.55	0.85	1.9	2.65	5.65	17.25	4.4	2.3	1.7	2.5
13	1.6	3.1	1.4	0.75	1.9	2.55	5.4	14.8	4.0	2.3	1.7	2.35
14	1.6	3.4	1.35	0.7	1.9	2.45	5.45	11.5	3.95	2.3	1.7	2.3
15	1.55	3.5	1.3	0.7	1.9	2.4	5.3	9.3	3.75	2.3	1.7	2.3
16	1.4	3.15	1.3	0.7	1.95	2.35	4.1	8.25	3.6	2.4	1.7	2.3
17	1.4	2.9	1.25	0.75	2.1	2.3	4.8	8.3	3.5	2.4	1.8	2.25
18	1.4	2.9	1.1	0.75	2.75	2.25	7.4	7.35	3.25	2.35	1.9	2.3
19	1.3	3.1	1.1	0.75	2.8	2.2	8.25	6.4	3.1	2.2	1.9	2.25
20	1.25	3.7	1.1	0.7	2.75	2.3	9.0	5.6	3.0	2.15	1.9	2.1

Daily gage height, in feet, of Rio Grande near Langtry, Tex., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	1.25	3.9	1.05	0.7	2.55	2.4	9.1	5.4	3.0	2.1	1.9	2.0
22	1.2	3.9	1.0	0.7	2.7	2.55	9.2	5.55	3.0	2.0	1.85	2.0
23	1.2	3.9	1.0	0.7	2.85	2.7	8.6	7.25	3.1	1.95	1.85	1.95
24	1.2	3.75	1.0	0.75	2.85	2.95	8.35	9.45	3.1	1.9	1.9	1.9
25	1.2	3.55	0.9	0.8	2.9	2.75	8.6	9.3	3.0	1.9	1.9	1.9
26	1.2	3.15	0.8	0.8	3.0	2.8	8.7	9.9	3.2	1.9	1.9	1.9
27	1.1	2.9	0.8	0.95	3.0	2.9	9.2	10.6	3.35	1.85	1.95	1.9
28	1.1	2.8	0.8	0.95	3.15	3.0	10.7	11.8	3.25	1.85	1.95	1.9
29	1.1	.....	0.7	1.5	3.2	3.5	10.7	12.35	3.1	1.75	2.0	1.9
30	1.1	.....	0.7	2.65	3.2	3.2	7.5	15.15	3.1	1.7	1.95	1.8
31	1.2	.....	0.7	.....	3.25	.....	6.75	14.3	.....	1.7	.....	1.75

Daily discharge, in second-feet, of Rio Grande near Langtry, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,700	1,750	3,650	1,180	1,750	5,670	3,670	9,100	29,680	4,180	1,830	2,600
2	3,250	1,820	[a]3,300	1,200	[a]1,890	[a]6,130	3,430	[a]8,260	25,450	[a]4,400	[a]1,860	2,170
3	3,030	1,810	3,260	1,270	2,040	6,730	3,250	8,360	[a]21,960	5,000	1,860	2,170
4	2,920	1,800	3,110	1,300	2,550	10,570	3,070	11,360	18,520	4,240	1,850	2,170
5	[a]2,740	1,790	3,000	1,320	2,780	6,260	2,900	15,460	16,480	4,040	1,850	2,030
6	2,670	1,780	2,890	1,340	2,550	6,140	3,390	17,770	13,040	[a]3,850	1,840	[a]2,030
7	2,600	1,770	[a]2,850	[a]1,360	[a]2,850	[a]5,820	3,330	21,310	[a]11,790	3,650	[a]1,840	1,930
8	2,540	1,770	2,680	1,360	2,770	5,150	3,760	[a]29,360	10,680	3,360	1,840	1,910
9	[a]2,410	2,080	2,680	1,360	2,770	4,980	[a]4,680	35,220	9,790	3,070	1,850	1,810
10	2,310	2,160	2,510	2,160	[a]2,770	4,210	4,570	39,620	8,130	[a]2,770	[a]1,850	[a]1,860
11	2,270	2,860	2,340	[a]1,580	2,790	[a]3,850	[a]8,460	57,890	[a]6,520	2,770	1,850	2,190
12	2,220	4,200	[a]2,130	1,430	2,800	3,470	8,250	[a]46,640	6,200	2,610	1,850	3,080
13	[a]2,220	4,680	1,960	1,350	2,820	3,280	7,710	37,470	5,560	2,610	1,850	2,840
14	2,220	5,280	1,900	1,310	[a]2,840	3,090	[a]7,820	[a]25,540	5,480	2,610	1,850	[a]2,760
15	2,170	5,480	1,840	[a]1,310	2,840	[a]2,990	7,500	19,410	5,160	[a]2,610	[a]1,850	2,700
16	2,030	4,540	[a]1,840	1,310	2,880	2,970	5,100	16,500	4,920	2,660	1,850	2,650
17	[a]2,030	3,870	1,780	1,340	2,990	2,950	6,290	[a]16,640	[a]4,770	2,560	2,020	[a]2,550
18	1,980	3,870	1,600	1,340	3,480	2,930	13,410	14,330	4,280	[a]2,380	2,190	2,590
19	1,840	4,300	1,590	[a]1,340	[a]3,640	2,910	15,750	12,020	3,980	2,230	[a]2,190	2,550
20	1,750	5,620	1,590	1,300	3,630	[a]2,950	[a]17,810	10,080	[a]3,780	2,240	2,190	2,420
21	1,700	6,050	[a]1,530	1,280	3,320	3,080	18,260	[a]9,600	3,830	2,260	2,190	2,330
22	[a]1,610	6,050	1,470	1,260	3,710	3,270	18,700	9,960	3,830	[a]2,190	2,110	2,330
23	1,600	6,050	1,470	[a]1,240	[a]4,110	[a]3,470	17,050	13,930	4,010	2,100	[a]2,110	2,280
24	1,590	5,760	1,470	1,290	4,040	3,800	16,450	19,080	4,040	2,020	2,150	2,240
25	[a]1,580	5,380	[a]1,410	1,340	4,070	3,540	[a]17,350	[a]18,730	[a]3,910	[a]2,010	2,120	2,240
26	1,580	4,640	1,300	1,340	4,200	3,600	17,650	20,340	4,290	2,010	2,080	2,240
27	1,490	4,190	1,300	[a]1,490	4,140	3,730	19,150	22,220	4,590	1,920	2,130	2,240
28	1,490	4,010	[a]1,300	1,490	[a]4,390	3,870	24,040	25,450	[a]4,490	[a]1,910	[a]2,100	2,240
29	[a]1,490	.....	1,200	2,100	4,740	5,070	[a]24,040	26,930	4,250	1,800	2,180	[a]2,240
30	1,490	.....	1,200	3,350	4,970	4,350	14,050	[a]34,460	4,250	1,770	2,100	2,140
31	1,580	.....	1,200	.....	5,320	.....	11,800	32,170	.....	1,800	.....	2,090

[a] Dates of measurements.

Monthly discharge of Rio Grande near Langtry, Tex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	3,700	1,490	2,132	131,107
February	6,050	1,750	3,763	208,979
March	3,650	1,200	2,044	125,653
April	3,350	1,180	1,455	86,558
May	5,320	1,750	3,305	203,187
June	10,570	2,910	4,361	259,497
July	24,040	2,900	10,732	659,881
August	57,890	8,260	22,200	1,365,044
September	29,680	3,780	8,588	511,002
October	5,000	1,770	2,762	169,845
November	2,190	1,830	1,981	117,878
December	3,080	1,810	2,310	142,056
The year	57,890	1,200	5,469	3,980,687

RIO GRANDE BELOW MOUTH OF DEVILS RIVER, TEXAS.

This station was established in April, 1900, by the International (Water) Boundary Commission. It is alongside the Southern Pacific Railroad track, about a mile below the mouth of Devils River and about 480 miles below El Paso. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 67, where are given also references to publications that contain data for previous years.

Discharge measurements of Rio Grande below mouth of Devils River, Texas, in 1906.

[By E. E. Winter.]

Date.	Area of section.	Gage height.	Discharge.	Date.	Area of section.	Gage height.	Discharge.
	Sq. ft.	*Feet.*	*Sec.-ft.*		*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 3	1,416	5.0	4,998	July 6	1,717	5.05	5,102
January 6	1,319	4.7	4,004	July 13	2,527	7.7	11,302
January 11	1,220	4.4	3,413	July 15	2,441	7.4	10,179
January 16	1,186	4.2	3,287	July 19	3,019	9.15	14,831
January 19	1,258	4.1	3,522	July 23	3,023	9.2	15,803
January 23	1,201	4.0	3,068	July 27	3,221	9.85	17,609
January 27	1,202	4.0	3,049	July 31	2,870	8.25	13,835
January 31	1,199	4.0	3,072	August 5	3,017	8.65	16,206
February 6	1,415	4.1	3,109	August 10	4,100	13.15	31,760
February 10	1,313	4.0	3,300	August 15	3,640	12.3	27,543
February 16	1,803	5.7	6,889	August 19	3,067	8.65	18,228
February 21	1,889	6.3	8,315	August 23	3,307	9.8	20,486
February 25	1,812	6.0	7,900	August 31	4,333	14.2	33,982
February 28	1,803	5.6	7,157	September 6	3,353	9.0	18,633
March 6	1,354	4.65	4,066	September 10	2,783	7.5	13,123
March 9	1,299	4.2	4,076	September 15	2,162	6.05	8,168
March 15	1,207	3.95	3,342	September 18	1,987	5.8	6,944
March 20	1,148	3.8	2,995	September 22	2,333	6.1	8,374
March 24	1,137	3.65	2,739	September 26	2,233	5.9	8,452
March 27	1,150	3.5	2,600	September 30	1,944	5.5	6,549
March 31	1,124	3.3	2,505	October 5	1,790	5.2	5,495
April 10	1,125	3.25	2,496	October 9	1,606	4.7	4,386
April 14	1,151	3.4	2,597	October 13	1,572	4.5	4,258
April 18	1,115	3.3	2,520	October 17	1,570	4.5	4,296
April 22	1,119	3.2	2,459	October 21	1,513	4.3	3,707
April 26	1,167	3.3	2,548	October 24	1,528	4.2	3,946
April 30	1,873	5.7	6,337	October 27	1,462	4.1	3,721
May 5	1,288	4.0	3,477	October 31	1,387	4.0	3,384
May 9	1,452	4.45	4,525	November 6	1,364	3.95	3,030
May 12	1,408	4.3	4,061	November 9	1,353	3.95	3,023
May 17	1,307	4.05	3,523	November 14	1,340	4.0	3,171
May 22	1,514	4.65	4,534	November 17	1,332	4.0	3,194
May 26	1,621	5.2	5,117	November 22	1,316	3.95	3,031
May 30	1,657	5.3	5,559	November 26	1,332	4.0	3,162
June 6	2,095	6.6	8,597	November 30	1,306	4.05	3,247
June 9	1,734	5.4	5,622	December 4	1,578	4.1	3,631
June 14	1,559	4.7	4,509	December 9	1,546	4.2	3,610
June 19	1,602	4.8	4,755	December 12	1,610	4.6	4,196
June 22	1,656	4.8	5,119	December 16	1,607	4.8	4,258
June 27	1,708	5.0	5,112	December 20	1,579	4.6	4,279
June 30	1,761	5.6	5,704	December 31	1,540	4.1	3,793

Daily gage height, in feet, of Rio Grande, below mouth of Devils River, Texas, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.35	4.2	5.25	3.3	4.0	5.5	5.55	7.4	13.2	5.4	3.95	4.1
2	5.2	4.2	5.1	3.25	3.8	5.6	5.1	7.05	12.55	5.15	3.95	4.2
3	4.95	4.1	4.9	3.3	3.9	6.5	5.0	7.05	11.15	5.7	3.95	4.2
4	4.85	4.15	4.8	3.35	4.0	6.9	4.6	7.8	10.65	5.35	3.95	4.1
5	4.8	4.1	4.75	3.4	3.95	6.7	4.35	8.65	9.45	5.15	3.95	4.1
6	4.75	4.1	4.6	3.35	4.0	6.3	4.65	9.3	9.0	5.0	3.95	4.1
7	4.65	4.05	4.45	3.35	4.2	5.85	5.7	11.9	8.9	4.95	3.95	4.1
8	4.55	4.0	4.35	3.4	4.4	5.6	7.0	11.3	8.6	4.85	3.95	4.1
9	4.45	4.0	4.25	3.35	4.5	5.4	7.75	12.8	7.95	4.7	3.95	4.2
10	4.4	4.0	4.15	3.5	4.6	5.25	7.25	13.6	7.5	4.6	3.95	4.45
11	4.4	4.25	4.1	3.7	4.45	5.1	7.95	18.65	7.25	4.55	3.95	4.65
12	4.35	5.0	4.05	3.55	4.3	5.1	7.75	23.85	6.9	4.5	3.95	4.7
13	4.3	5.4	4.0	3.45	4.25	4.85	7.65	19.0	6.6	4.55	4.0	4.9
14	4.2	5.65	4.0	3.4	4.2	4.7	7.05	13.5	6.3	4.65	4.0	5.0
15	4.2	5.9	3.95	3.3	4.15	4.65	7.55	12.4	6.05	4.5	4.0	4.9
16	4.2	5.65	3.9	3.25	4.1	4.85	6.8	10.5	5.9	5.05	4.0	4.8
17	4.2	5.45	3.85	3.3	4.05	4.85	6.8	9.85	5.8	4.55	4.0	4.8
18	4.2	5.4	3.85	3.3	4.2	4.7	8.0	10.2	5.7	4.45	3.95	4.75
19	4.1	5.45	3.8	3.3	4.8	4.8	9.1	8.05	5.65	4.5	3.95	4.65
20	4.1	6.0	3.8	3.3	5.0	5.1	9.5	6.35	5.8	4.35	3.95	4.6
21	4.1	6.3	3.7	3.25	4.6	4.8	9.7	6.85	6.05	4.3	3.95	4.5
22	4.05	6.4	3.7	3.2	4.7	4.8	10.35	7.7	6.4	4.2	3.95	4.4
23	4.0	6.25	3.7	3.2	4.85	4.75	9.95	9.1	6.3	4.2	3.95	4.4
24	4.0	6.1	3.6	3.2	4.95	4.8	9.1	10.65	5.6	4.2	3.95	4.3
25	4.0	6.0	3.6	3.3	5.0	4.9	9.45	10.75	5.5	4.2	4.0	4.3
26	4.0	5.8	3.5	3.3	5.2	4.9	9.8	9.85	5.95	4.15	4.0	4.3
27	4.0	5.65	3.5	3.3	5.2	5.0	10.0	12.05	5.95	4.1	4.0	4.3
28	4.0	5.5	3.45	3.4	5.25	5.0	10.05	12.8	6.0	4.1	4.0	4.3
29	4.0	.....	3.35	3.55	5.25	5.1	11.75	12.45	5.7	4.0	4.05	4.2
30	4.0	.....	3.3	5.85	5.[illegible]	5.6	9.2	13.5	5.45	4.0	4.05	4.15
31	4.0	.....	3.3	.....	5.4	.....	8.15	14.2	.....	4.0	.....	4.1

Daily discharge in second-feet of Rio Grande below mouth of Devils River, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6,170	3,440	6,020	2,510	3,480	6,030	5,650	10,180	31,030	6,200	3,240	3,400
2	5,670	3,420	5,540	2,470	3,150	6,270	5,160	9,130	29,110	5,320	3,200	3,640
3	a4,830	3,190	4,890	2,520	3,310	8,370	5,050	9,130	24,980	7,250	3,160	3,710
4	4,500	3,260	4,560	2,560	3,480	9,310	4,600	12,440	23,500	6,020	3,120	a3,630
5	4,330	3,130	4,400	2,600	a3,400	8,840	4,330	a16,210	19,960	a5,380	3,070	3,590
6	a4,170	a3,110	a3,920	2,570	3,480	a7,850	a4,660	18,450	a18,630	5,050	a3,030	3,560
7	3,910	3,110	3,920	2,570	3,950	6,730	6,620	27,440	18,270	4,940	3,030	3,520
8	3,710	3,110	4,070	2,620	4,420	6,110	9,660	25,370	17,160	4,720	3,020	3,490
9	3,510	3,200	a4,220	2,580	4,680	a5,620	11,420	30,550	14,770	a4,390	3,020	a3,610
10	3,410	a3,300	3,930	a2,700	4,990	5,380	10,250	a34,460	a13,120	4,250	3,030	3,970
11	a3,410	3,820	3,780	2,860	4,520	5,140	11,890	74,860	12,270	4,220	3,040	4,270
12	3,380	5,410	3,630	2,720	a4,060	5,140	11,420	121,660	11,070	4,190	3,050	a4,400
13	3,350	6,250	3,490	2,640	3,950	4,750	a11,190	78,010	10,040	a4,360	3,160	4,800
14	3,290	6,780	3,490	a2,600	3,850	a4,510	9,540	34,400	9,020	4,570	a3,170	4,900
15	3,290	7,310	a3,340	2,520	3,740	4,420	a10,580	a28,000	a8,170	4,280	3,170	4,580
16	a3,290	a6,790	3,220	2,480	3,630	4,830	8,580	22,950	7,430	5,390	3,180	a4,260
17	3,430	6,490	3,110	2,520	a3,520	4,840	8,580	21,300	6,940	a4,400	a3,190	4,360
18	3,580	6,390	3,110	a2,520	3,790	4,550	11,780	22,190	a6,640	4,150	3,070	4,370
19	a3,520	6,490	3,000	2,520	5,050	a4,760	a14,700	a15,720	6,490	4,200	3,060	4,280
20	3,450	7,670	a3,000	2,520	5,430	5,480	16,230	8,600	7,120	3,850	3,050	a4,280
21	3,390	a8,310	2,820	2,490	4,490	5,000	17,030	10,320	8,170	a3,710	3,040	4,150
22	3,230	8,520	2,820	a2,460	a4,640	a5,120	20,280	13,250	a9,570	3,650	a3,030	4,020
23	a3,070	8,290	2,820	2,460	4,820	4,980	a18,720	a18,080	9,390	3,800	a3,040	4,040
24	3,070	8,060	a2,690	2,460	4,880	5,000	15,520	23,100	6,810	a3,950	3,050	3,910
25	3,060	7,900	2,690	2,550	4,830	5,080	16,490	23,410	6,630	3,950	3,150	3,940
26	3,050	7,530	2,600	a2,550	a5,120	5,020	17,470	20,640	a8,690	3,840	a3,160	3,970
27	a3,050	7,250	a2,600	2,550	5,170	a5,110	a18,200	27,400	8,690	a3,720	3,160	4,000
28	3,050	a6,970	2,570	2,640	5,340	5,110	18,450	29,700	8,930	3,690	3,160	4,020
29	3,060	.....	2,520	2,790	5,390	5,210	28,450	28,610	7,500	3,450	3,250	3,890
30	3,070	.....	2,500	a6,640	a5,560	a5,710	16,730	31,840	a6,310	3,420	a3,250	3,840
31	a3,070	.....	a2,500	.....	5,800	.....	a13,680	a33,980	.....	a3,380	.....	3,790

a Dates of measurements.

Monthly discharge of Rio Grande below mouth of Devils River, Tex., for 1906.

Month	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	6,170	3,050	3,625	222,883
February	8,520	3,110	5,661	314,380
March	6,020	2,500	3,476	213,759
April	6,640	2,460	2,706	161,038
May	5,800	3,150	4,385	269,593
June	9,310	4,420	5,676	337,726
July	28,450	4,330	12,352	759,491
August	121,660	8,600	28,432	1,748,192
September	31,030	6,310	12,547	746,598
October	7,250	3,380	4,442	273,104
November	3,250	3,020	3,112	185,157
December	4,900	3,400	4,006	246,327
The year	121,660	2,460	7,535	5,478,248

RIO GRANDE AT EAGLE PASS, TEX.

This station was established in April, 1900, by the International (Water) Boundary Commission. It is a half mile above the highway bridge between Eagle Pass, Tex., and Ciudad Porfirio Diaz, Mexico, and about 540 miles below El Paso. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 71, where are given also references to publications that contain data for previous years.

Discharge measurements of Rio Grande at Eagle Pass, Tex., in 1906.

[By J. K. Wilson.]

Date.	Area of section.	Gage height.	Discharge.	Date.	Area of section.	Gage height.	Discharge.
	Sq. ft.	*Feet.*	*Sec.-ft.*		*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 3	2,460	3.6	5,553	April 24	1,486	2.0	2,011
January 7	2,296	3.4	4,966	April 27	1,554	2.1	2,373
January 10	2,394	3.3	5,333	April 30	1,692	2.3	2,865
January 14	2,411	3.0	5,209	May 4	1,818	2.5	3,566
January 17	2,284	3.0	4,785	May 6	2,040	2.7	4,538
January 20	2,213	2.9	4,809	May 9	2,134	3.0	4,830
January 23	2,230	2.8	4,692	May 12	2,083	3.0	4,615
January 26	2,214	2.8	4,618	May 15	1,838	2.9	4,213
January 29	2,097	2.8	4,217	May 18	1,820	2.8	4,005
January 31	2,085	2.7	4,029	May 22	1,857	3.1	5,216
February 3	2,052	2.8	4,099	May 25	1,935	3.4	5,805
February 6	2,094	2.8	3,984	May 28	2,052	3.6	5,933
February 9	2,065	2.8	4,274	May 31	2,135	3.8	6,862
February 13	2,398	3.7	7,528	June 3	2,256	3.9	7,611
February 16	2,234	4.1	7,942	June 7	2,464	4.3	9,140
February 20	2,199	3.7	7,642	June 10	2,283	3.9	7,794
February 23	2,362	4.4	10,023	June 13	2,286	3.7	6,996
February 26	2,351	4.1	9,087	June 16	2,144	3.2	5,745
February 28	2,226	3.9	7,854	June 19	2,070	3.2	5,209
March 3	2,229	3.45	7,317	June 22	2,072	3.2	5,235
March 6	2,082	3.1	5,355	June 25	2,005	3.1	4,949
March 9	1,961	3.0	4,458	June 28	2,135	3.35	6,088
March 12	1,973	2.8	4,288	June 30	2,164	3.4	6,343
March 17	1,932	2.6	3,886	July 3	2,290	3.4	6,839
March 25	1,780	2.3	3,137	July 7	2,545	4.0	8,359
March 28	1,697	2.2	2,982	July 10	3,465	6.15	16,725
March 31	1,654	2.0	2,680	July 13	3,796	6.5	19,380
April 3	1,590	2.0	2,403	July 16	3,524	6.1	16,960
April 6	1,684	2.0	2,724	July 19	3,874	6.9	22,023
April 9	1,653	2.0	2,620	July 22	4,671	7.8	27,782
April 12	1,582	2.0	2,410	July 25	3,972	7.3	21,642
April 15	1,539	2.0	2,297	July 28	4,559	7.85	26,671
April 18	1,539	2.0	2,227	July 31	3,068	6.2	15,372
April 21	1,533	2.0	2,248	August 3	3,373	5.7	15,936

Discharge measurements of Rio Grande at Eagle Pass, Tex., in 1906—Continued.

Date.	Area of section.	Gage height.	Discharge.	Date.	Area of section.	Gage height.	Discharge.
	Sq. ft.	*Feet.*	*Sec.-ft.*		*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 9	5,532	9.4	35,310	October 19	2,131	3.3	5,944
August 13	11,182	18.5	a140,652	October 22	2,081	3.3	5,376
August 15	7,189	10.6	a 57,445	October 25	1,951	3.2	4,856
August 17	5,384	8.4	28,179	October 28	1,986	3.2	4,571
August 20	4,185	6.8	19,109	October 31	1,939	3.1	4,337
August 23	4,020	6.25	16,150	November 3	1,946	3.0	4,366
August 26	5,447	8.2	30,007	November 9	2,092	2.9	4,691
August 28	6,810	10.2	a 53,527	November 12	2,049	2.9	4,453
August 31	7,488	11.0	a 57,830	November 15	2,074	3.0	4,357
September 3	6,620	10.2	a 52,734	November 18	2,143	2.9	4,506
September 5	5,262	8.15	27,058	November 21	2,088	3.0	4,492
September 7	4,011	7.1	18,616	November 24	2,127	3.0	4,598
September 10	4,012	6.35	17,290	November 27	2,232	3.1	4,829
September 13	3,323	5.5	13,007	November 30	2,282	3.2	4,971
September 16	3,088	4.85	12,087	December 3	2,328	3.3	5,243
September 20	2,978	4.7	10,648	December 6	2,335	3.2	5,239
September 23	3,102	5.3	15,474	December 10	2,356	3.3	5,169
September 27	2,836	4.8	11,670	December 13	2,418	3.5	6,191
September 30	3,066	4.6	10,534	December 16	2,455	3.55	6,422
October 3	2,633	4.0	10,492	December 19	2,369	3.4	5,852
October 6	2,451	3.9	8,906	December 22	2,243	3.4	5,458
October 9	2,428	3.8	8,897	December 26	2,017	3.2	5,214
October 12	2,194	3.5	6,542	December 29	2,037	3.0	5,454
October 16	2,198	3.4	6,711	December 31	1,992	2.9	5,148

a Velocity by floats.

Daily gage height, in feet, of Rio Grande at Eagle Pass, Tex., for 1906

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.7	2.85	3.8	2.0	3.8	3.85	3.8	6.25	11.35	4.15	3.1	3.2
2	3.65	2.9	3.7	2.0	2.6	3.9	3.6	5.85	10.85	4.1	3.0	3.25
3	3.65	2.85	3.45	2.0	2.35	3.9	3.4	5.7	10.0	4.0	3.0	3.3
4	3.6	2.8	3.35	2.0	2.35	5.1	3.4	5.6	9.2	3.9	3.0	3.3
5	3.6	2.8	3.2	2.0	2.6	5.85	3.2	6.1	8.15	3.9	3.0	3.3
6	3.5	2.8	3.25	2.0	2.7	4.65	3.2	6.75	8.05	3.85	3.0	3.2
7	3.4	2.8	3.4	2.0	2.7	4.3	4.1	8.6	7.15	3.8	3.0	3.1
8	3.3	2.8	3.1	2.0	3.0	4.2	5.5	8.9	7.1	3.8	3.0	3.1
9	3.3	2.8	2.95	2.0	3.0	3.95	6.55	9.55	6.65	3.8	2.9	3.1
10	3.3	2.7	2.9	2.0	3.0	3.9	6.4	10.35	6.3	3.75	2.9	3.25
11	3.2	2.7	2.8	2.0	3.0	3.8	6.25	10.8	6.0	3.6	2.9	3.45
12	3.2	3.05	2.8	2.0	3.0	3.7	6.45	14.0	5.7	3.5	2.9	3.5
13	3.15	3.6	2.7	2.0	2.95	3.7	6.45	19.7	5.45	3.5	2.9	3.5
14	3.0	3.8	2.7	2.0	2.9	3.6	6.4	15.0	5.15	3.75	2.75	3.4
15	3.0	4.1	2.7	2.0	2.9	3.3	6.2	10.7	4.95	3.5	3.0	3.6
16	3.0	4.15	2.7	2.0	2.75	3.2	6.0	9.45	4.85	3.4	2.9	3.55
17	3.0	3.95	2.6	2.0	2.7	3.25	6.2	8.25	4.7	3.45	2.9	3.45
18	3.0	3.85	2.6	2.0	2.8	3.25	5.95	8.3	4.7	3.35	2.9	3.4
19	2.95	3.8	2.5	2.0	3.15	3.2	7.0	7.4	4.65	3.3	3.0	3.4
20	2.9	3.7	2.4	2.0	3.5	3.4	7.25	6.8	4.7	3.3	3.0	3.4
21	2.9	3.7	2.35	2.0	3.7	3.4	7.65	6.45	4.75	3.3	3.0	3.4
22	2.9	4.5	2.3	2.0	3.1	3.2	7.85	6.25	4.85	3.3	3.0	3.4
23	2.8	4.4	2.3	2.0	3.2	3.2	8.0	6.45	5.35	3.2	3.0	3.3
24	2.8	4.2	2.3	2.0	3.35	3.1	7.4	7.9	4.8	3.2	3.0	3.3
25	2.8	4.2	2.3	2.0	3.4	3.1	7.15	8.2	4.45	3.2	3.0	3.25
26	2.8	4.15	2.3	2.0	3.6	3.3	7.65	8.0	4.7	3.2	3.05	3.2
27	2.8	3.95	2.2	2.05	3.55	3.3	7.7	8.1	4.8	3.2	3.1	3.1
28	2.8	3.9	2.2	2.25	3.6	3.35	7.9	10.25	4.85	3.15	3.2	3.1
29	2.8	.....	2.15	2.35	3.6	3.4	8.65	9.7	4.7	3.1	3.2	3.0
30	2.7	.....	2.1	2.3	3.65	3.4	8.4	10.25	4.5	3.1	3.25	3.0
31	2.7	.....	2.0	.....	3.7	.....	6.35	10.7	.....	3.1	.....	2.9

Daily discharge, in second-feet, of Rio Grande at Eagle Pass, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5,860	4,290	7,730	2,590	6,860	7,170	7,880	16,430	63,530	9,520	4,420	4,970
2	5,710	4,350	7,610	2,500	3,780	7,480	7,360	15,680	59,030	10,110	4,290	5,110
3	a5,710	a4,200	a7,320	a2,400	3,270	a7,610	a6,840	a5,940	a50,230	a10,490	a4,370	a5,240
4	5,550	4,060	6,700	2,510	a3,270	12,340	6,840	[illegible] 410	40,210	9,700	4,450	5,310
5	5,550	4,020	5,980	2,620	4,050	15,340	6,340	18,[illegible]30	a27,060	9,310	4,540	5,370
6	5,260	a3,980	a5,660	a2,720	a4,540	10,540	6,340	21,440	26,250	a8,710	4,630	a5,240
7	a4,970	4,070	5,720	2,690	4,440	a9,140	a8,750	31,120	a19,020	8,640	4,710	4,970
8	4,960	4,170	4,890	2,660	4,940	8,800	14,210	32,700	19,680	8,770	4,800	4,900
9	5,150	a4,270	a4,410	a2,620	a4,830	7,960	19,130	a36,660	18,040	a8,900	4,690	4,840
10	a5,330	4,070	4,370	2,550	4,760	a7,790	a18,230	43,860	a17,040	8,320	4,610	a5,070
11	5,290	4,070	4,290	2,480	4,690	7,420	17,510	49,930	15,530	7,330	4,530	5,680
12	5,290	5,280	a4,290	a2,410	a4,620	7,060	18,900	93,150	14,010	a6,540	a4,450	5,980
13	5,270	a7,180	4,090	2,370	4,440	a7,000	a19,080	a178,650	a12,800	6,670	4,350	a6,190
14	a5,210	7,630	4,090	2,330	4,270	6,750	18,780	114,920	12,160	7,680	3,950	6,030
15	5,070	7,940	4,090	a2,300	a4,210	6,000	17,570	a58,750	11,920	6,930	a4,360	6,480
16	4,930	a8,000	4,090	2,280	3,900	a5,750	a16,360	42,150	a12,090	a6,710	4,270	a6,420
17	a4,790	7,830	3,890	2,250	3,800	5,700	17,590	27,330	11,280	6,700	4,390	6,130
18	4,860	7,750	3,870	a2,230	a4,000	5,520	16,060	27,610	11,070	6,240	a4,510	5,940
19	4,8[illegible]0	7,710	3,650	2,230	4,970	a5,210	a22,660	22,510	10,660	a5,940	4,600	a5,850
20	a4,810	a7,670	3,430	2,240	5,930	5,720	24,260	a19,110	a10,650	5,750	4,600	5,720
21	4,810	7,670	3,310	a2,250	6,530	5,730	26,820	17,230	11,660	5,560	a4,600	5,590
22	4,810	10,360	3,190	2,170	a5,220	a5,230	a28,180	16,150	12,870	a5,380	4,600	a5,460
23	a4,690	a10,020	3,170	2,090	5,410	5,220	29,380	a17,570	a15,670	5,000	4,600	5,340
24	4,660	9,400	3,150	a2,010	5,740	4,960	22,740	27,880	13,020	4,930	a4,600	5,340
25	4,640	9,400	a3,140	2,060	a5,800	a4,950	a20,590	30,010	11,170	a4,860	4,600	5,270
26	a4,620	9,240	3,140	2,110	6,220	5,660	24,480	a28,590	11,720	4,760	4,710	a5,210
27	4,480	8,320	2,980	a2,270	5,940	5,810	25,220	29,300	a11,670	4,670	a4,830	5,230
28	4,350	7,850	a2,980	2,700	a5,930	a6,090	a27,070	a54,130	11,760	a4,450	4,970	5,440
29	a4,220	.....	2,900	2,930	6,040	6,290	33,070	48,530	11,040	4,340	4,970	a5,450
30	4,030	.....	2,830	a2,860	6,300	a6,340	31,070	52,460	a10,130	4,340	a5,040	5,400
31	4,030	.....	2,680	.....	a6,560	.....	16,270	a55,680	.....	a4,340	.....	5,150

a Dates of measurements.

Monthly discharge of Rio Grande at Eagle Pass, Tex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	5,860	4,030	4,960	304,959
February	10,360	3,980	6,600	366,545
March	7,730	2,680	4,311	265,071
April	2,930	2,010	2,414	143,663
May	6,860	3,270	5,008	307,954
June	15,340	4,950	7,086	421,646
July	33,070	6,340	18,567	1,141,646
August	178,650	15,410	40,610	2,497,011
September	63,530	10,130	19,432	1,156,304
October	10,490	4,340	6,825	419,683
November	5,040	3,950	4,568	271,815
December	6,480	4,840	5,494	337,825
The year	178,650	2,010	10,490	7,634,122

RIO GRANDE NEAR LAREDO, TEX.

This station was established in April, 1900, by the International (Water) Boundary Commission. It was intended to measure the river from the highway bridge connecting Laredo with Nuevo Laredo, Tamaulipas, and the gage was established on the right bank just above the bridge. Measurements were kept up by the Mexican section of the Commission for five months, but the results were so conflicting that the station was abandoned. In July, 1903, a cable

station was established by the Commission about 2 miles above Nuevo Laredo, crossing to the United States military reservation of Fort McIntosh, the cable landing just below the pump house. The station is about 670 miles below El Paso.

The river at the new section is nearly straight for one-half mile above and below the cable. The right bank is alluvial deposit, but is above high water. The left bank is the talus of a shale bluff going well above high water. The bed is shifting sand.

Discharge measurements are made by means of a cable, car, and guy wire. The initial point for soundings is the cable support on the right bank.

The gage is an inclined scantling fastened to posts and trees. Low water is about 1 foot on the gage. The highest flood recorded is 32.2 feet, on the night of June 30, 1905.

The observations during 1905 were made under the direction of the Mexican section of the International (Water) Boundary Commission. The conditions at the station are described in Water-Supply Paper No. 174, page 76.

Discharge measurements of Rio Grande near Laredo, Tex., in 1906.

[By Luis Varela.]

Date.	Area of section.	Gage height.	Discharge.	Date.	Area of section.	Gage height.	Discharge.
	Sq. ft.	*Feet.*	*Sec.-ft.*		*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 8	2,384	4.1	5,269	July 23	4,518	9.6	23,855
January 15	2,172	3.9	4,735	July 27	4,116	8.8	18,983
January 16	2,078	3.9	4,467	July 28	4,154	8.9	19,399
January 20	1,910	3.8	4,213	July 30	4,603	11.0	27,903
January 25	1,722	3.7	3,671	August 3	3,391	6.65	15,476
January 29	1,602	3.6	3,593	August 8	4,676	10.25	21,564
February 7	1,676	3.6	3,550	August 12	5,679	12.8	32,529
February 14	1,857	4.3	4,944	August 13	7,836	18.0	49,288
February 15	2,188	4.8	6,345	August 14	9,580	22.0	53,648
February 17	2,379	5.2	7,837	August 15	6,936	15.8	40,070
February 24	2,789	5.4	8,460	August 20	4,146	8.8	22,043
February 28	2,468	4.85	7,030	August 24	3,609	7.5	18,215
March 6	1,828	4.0	4,109	August 26	4,550	9.9	26,964
March 12	1,809	3.8	3,986	August 30	5,315	11.5	31,219
March 20	1,694	3.2	2,967	September 3	6,196	12.8	35,547
March 23	1,655	3.25	3,353	September 7	4,100	9.4	18,373
March 27	1,554	3.15	2,968	September 15	2,875	6.0	10,974
March 30	1,439	3.0	2,489	September 19	2,728	5.6	9,247
April 5	1,382	2.9	2,479	September 22	3,122	5.5	11,219
April 11	1,471	3.0	2,613	September 25	2,783	5.9	10,616
April 14	1,544	3.2	3,102	September 29	3,287	5.75	12,838
April 18	1,413	3.0	2,559	October 3	2,787	5.0	9,036
April 23	1,518	3.0	2,696	October 8	2,474	4.7	7,576
April 28	1,508	3.0	2,764	October 13	2,303	4.3	6,183
May 1	1,600	3.3	3,077	October 18	2,048	4.2	4,993
May 3	2,075	4.65	6,897	October 22	1,950	4.1	4,840
May 13	1,700	4.8	4,344	October 27	2,197	4.0	4,636
May 20	2,019	4.8	6,863	October 30	2,079	3.9	4,930
May 23	3,299	6.35	12,888	November 4	1,987	3.8	4,452
May 29	2,562	4.7	6,730	November 9	1,968	3.9	4,991
June 5	3,008	6.8	9,851	November 14	1,853	3.7	4,484
June 6	3,179	7.1	11,377	November 20	1,879	3.9	4,745
June 15	1,802	4.3	5,114	November 29	1,941	4.0	5,267
June 22	2,072	4.3	6,364	December 5	1,979	4.0	4,746
June 25	1,788	4.2	4,768	December 8	1,934	3.9	5,288
June 29	2,018	4.4	5,153	December 11	1,974	4.0	5,003
July 2	2,461	4.8	7,063	December 17	2,110	4.5	6,489
July 8	2,926	5.95	11,050	December 21	1,927	4.4	5,814
July 9	3,569	7.3	18,514	December 27	1,914	4.1	5,432
July 14	3,629	7.5	17,069	December 31	1,765	3.9	4,732
July 20	3,826	8.3	17,293				

Daily gage height, in feet, of Rio Grande near Laredo, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	5.0	3.5	4.75	3.0	3.15	4.8	4.65	9.8	12.9	5.65	3.9	4.0
2	4.9	3.5	4.6	2.9	4.4	4.85	4.8	7.1	14.0	5.35	3.9	4.0
3	4.85	3.5	4.5	2.9	5.0	4.95	4.9	6.9	12.75	5.0	3.85	3.9
4	4.7	3.5	4.4	2.9	5.0	5.15	5.0	6.2	12.25	5.0	3.85	4.0
5	4.45	3.5	4.35	2.9	4.75	6.65	5.25	6.8	10.85	5.1	3.9	4.0
6	4.4	3.5	4.3	2.9	4.7	6.95	4.8	7.2	9.3	4.95	3.9	4.0
7	4.35	3.6	4.2	2.9	4.8	6.25	4.8	8.15	9.3	4.75	3.95	3.9
8	4.25	3.6	4.05	2.9	4.8	5.35	5.75	10.3	8.6	4.7	3.9	3.9
9	4.2	3.6	4.0	3.0	4.8	4.95	7.2	9.7	8.3	4.65	3.9	3.95
10	4.15	3.75	3.9	3.0	4.8	4.85	8.05	11.25	8.0	4.6	3.8	3.95
11	4.1	3.8	3.85	3.05	4.8	4.65	8.0	12.0	8.05	4.5	3.85	4.0
12	4.1	3.9	3.8	3.1	4.8	4.55	8.15	13.0	7.55	4.4	3.8	4.1
13	4.0	4.05	3.7	3.2	4.8	4.5	8.25	15.9	7.0	4.35	3.8	4.2
14	4.0	4.3	3.7	3.3	4.9	4.4	7.4	21.0	6.65	4.35	3.7	4.25
15	3.9	4.8	3.6	3.4	5.2	4.3	6.85	17.5	6.1	4.5	3.7	4.3
16	3.9	5.4	3.55	3.2	5.15	4.25	6.45	12.15	5.9	4.6	3.6	4.5
17	3.85	5.2	3.5	3.2	5.0	4.15	7.3	11.3	5.8	4.5	3.6	4.5
18	3.8	5.0	3.4	3.1	5.0	4.1	7.25	9.5	5.65	4.25	3.75	4.35
19	3.8	4.95	3.4	3.05	5.6	4.1	7.4	9.75	5.55	4.3	3.8	4.3
20	3.7	4.9	3.2	3.0	4.75	4.3	7.95	8.65	5.55	4.2	3.9	4.3
21	3.65	4.85	3.2	3.0	4.7	4.3	8.45	8.65	5.65	4.25	3.9	4.4
22	3.6	5.35	3.2	3.0	4.8	4.3	8.85	9.9	5.55	4.2	3.85	4.3
23	3.6	5.4	3.15	3.0	5.85	4.2	9.55	8.75	5.8	4.05	3.95	4.25
24	3.7	5.45	3.1	3.0	5.25	4.2	9.2	7.75	6.55	4.1	4.0	4.25
25	3.6	5.3	3.1	3.0	4.95	4.2	8.8	9.3	5.8	4.1	4.0	4.3
26	3.55	5.2	3.1	3.0	4.8	4.3	8.2	9.8	5.8	4.05	3.95	4.25
27	3.5	5.05	3.05	3.0	4.7	4.35	8.8	9.7	5.7	4.0	3.95	4.05
28	3.5	4.95	3.0	3.0	4.7	4.55	8.9	9.75	5.8	3.95	3.9	4.0
29	3.55	.....	3.0	3.0	4.7	4.4	10.25	11.25	5.8	4.0	4.0	3.95
30	3.4	.....	3.0	3.15	4.7	4.55	10.95	11.25	5.7	3.9	4.0	3.95
31	3.5	.....	3.0	.....	4.7	.....	10.35	12.05	.....	3.95	.....	3.9

RIO GRANDE NEAR ROMA, TEX.

This station was established in 1900 by the International (Water) Boundary Commission. It is near Roma, Tex., 775 miles by river below El Paso. The conditions at the station are described in Water-Supply Paper No. 176, page 78.

Discharge measurements of Rio Grande near Roma, Tex., in 1906.

[By H. P. Guerra.]

Date.	Area of section.	Gage height.	Discharge.	Date.	Area of section.	Gage height.	Discharge.
	Sq. ft.	*Feet.*	*Sec.-ft.*		*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 4	2,320	4.5	7,204	April 23	1,697	3.2	3,735
January 8	2,232	4.3	5,952	April 28	1,279	2.1	2,181
January 12	2,106	4.1	5,310	May 2	1,629	3.0	3,188
January 19	2,347	4.6	7,344	May 4	2,159	4.5	5,435
January 26	2,050	4.0	4,836	May 8	1,706	3.3	3,941
January 31	1,986	3.9	4,561	May 19	2,765	5.5	9,526
February 8	1,941	3.9	4,392	May 23	3,043	6.3	13,275
February 13	1,868	3.7	4,110	May 28	2,474	4.9	7,326
February 17	2,726	5.7	7,829	June 4	2,640	5.3	8,443
February 19	2,589	5.3	6,595	June 7	3,241	6.7	14,293
February 22	2,414	5.0	6,154	June 13	2,405	4.8	6,904
February 26	2,647	5.5	7,335	June 16	2,273	4.5	6,303
March 5	2,321	4.8	5,750	June 21	2,087	4.1	5,305
March 9	2,010	4.1	4,821	June 28	2,769	5.7	9,281
March 13	1,858	3.7	4,273	July 2	2,159	4.6	6,179
March 16	1,788	3.5	4,019	July 7	3,220	6.9	14,276
March 23	1,641	3.1	3,489	July 9	6,545	13.3	28,812
March 28	1,543	2.8	3,026	July 11	7,217	15.6	34,009
April 9	1,427	2.5	2,678	July 19	4,056	9.0	19,277
April 14	1,373	2.3	2,463	July 24	4,576	10.1	21,550
April 17	1,486	2.7	2,955	July 31	5,064	11.3	26,698
April 21	1,585	3.0	3,400	August 2	3,671	8.2	16,866

Discharge measurements of Rio Grande near Roma, Tex., in 1906—Continued.

Date.	Area of section.	Gage height.	Discharge.	Date.	Area of section.	Gage height.	Discharge
	Sq. ft.	*Feet.*	*Sec.-ft.*		*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 6	3,584	7.6	15,821	October 9	2,951	6.3	10,682
August 10	4,870	10.8	24,953	October 13	2,739	5.8	9,564
August 13	6,366	13.9	30,012	October 18	2,818	6.0	10,118
August 15	8,216	17.6	47,122	October 24	2,660	5.7	9,423
August 20	4,719	10.5	23,337	October 30	2,592	5.5	8,363
August 25	4,034	9.0	17,717	November 2	2,816	5.5	8,426
August 29	5,432	12.1	28,608	November 7	2,669	5.3	7,712
September 3	6,002	13.2	27,321	November 12	2,715	5.4	7,975
September 7	5,009	11.2	25,440	November 17	2,626	5.2	7,603
September 10	4,432	10.0	22,197	November 23	2,914	5.7	9,173
September 14	3,907	8.4	18,231	November 29	2,848	5.6	9,089
September 17	3,341	7.5	14,770	December 4	2,750	5.8	10,247
September 21	3,210	7.0	13,671	December 10	2,666	5.6	9,607
September 25	4,023	8.8	19,722	December 14	2,909	6.2	11,343
September 29	3,264	7.2	14,457	December 18	3,013	6.4	12,222
October 2	3,146	6.8	12,115	December 22	2,845	6.0	10,887
October 5	3,050	6.6	11,630	December 29	2,612	5.5	9,025

Daily gage height, in feet, of Rio Grande near Roma, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.9	3.9	5.15	2.5	2.35	4.9	4.45	9.4	12.65	7.05	5.6	5.8
2	4.8	3.8	5.0	2.4	2.9	5.15	4.6	8.1	13.25	6.8	5.45	5.8
3	4.65	3.8	5.0	2.4	2.95	5.3	4.55	7.95	13.1	6.6	5.5	5.8
4	4.55	3.8	4.9	2.4	4.4	5.35	5.35	7.8	12.8	6.75	5.45	5.75
5	4.5	4.2	4.8	2.3	3.5	5.6	5.5	7.7	12.8	6.65	5.4	5.8
6	4.45	4.2	4.55	2.3	3.1	5.95	5.7	7.9	11.7	6.85	5.4	5.8
7	4.35	4.0	4.45	2.4	3.05	6.4	6.7	8.55	11.1	6.6	5.35	5.8
8	4.25	3.9	4.25	2.4	3.25	5.45	9.6	9.35	10.65	6.45	5.3	5.8
9	4.2	3.9	4.15	2.5	3.2	5.05	13.65	10.9	10.05	6.35	5.3	5.7
10	4.2	3.9	4.05	2.5	3.3	5.0	14.7	10.75	9.65	6.25	5.35	5.65
11	4.1	3.9	3.95	2.55	3.6	4.95	15.3	11.5	9.0	6.1	5.5	5.65
12	4.1	3.8	3.9	2.5	3.7	4.9	12.95	12.25	8.95	6.0	5.4	5.7
13	4.35	3.7	3.75	2.4	3.7	4.75	13.0	13.45	8.6	5.9	5.35	5.8
14	4.2	3.8	3.65	2.35	3.7	4.6	10.3	15.95	8.45	5.8	5.3	6.0
15	4.1	3.8	3.6	2.95	3.75	4.65	9.45	17.9	7.85	5.85	5.2	6.0
16	4.25	5.45	3.5	2.7	3.7	4.5	8.85	15.35	7.7	6.0	5.2	6.1
17	4.35	5.75	3.6	2.65	3.6	4.25	9.0	12.4	7.45	5.95	5.3	6.5
18	4.45	5.75	3.45	2.6	3.9	4.2	8.75	11.0	7.25	5.85	5.35	6.3
19	4.5	5.4	3.35	2.5	4.9	4.5	9.05	10.5	7.05	5.7	5.35	6.0
20	4.4	5.15	3.3	2.6	6.4	4.5	9.05	10.6	7.5	5.6	5.45	6.0
21	4.4	5.1	3.25	2.85	5.6	4.2	9.15	10.1	7.0	5.7	5.4	6.0
22	4.35	5.0	3.2	2.8	4.5	4.65	9.7	9.2	7.15	5.7	5.5	6.0
23	4.15	5.55	3.05	3.15	5.7	4.75	10.0	8.65	9.05	5.7	5.6	5.95
24	4.0	5.75	3.0	2.8	5.65	4.55	10.1	8.55	8.65	5.65	5.5	5.85
25	4.0	5.5	3.0	2.55	4.45	4.3	9.65	9.25	8.6	5.6	5.5	5.7
26	3.95	5.45	2.9	2.45	4.05	4.35	9.1	10.2	8.4	5.6	5.65	5.7
27	3.9	5.65	2.9	2.25	4.3	4.5	9.05	10.5	6.95	5.6	5.6	5.65
28	3.9	5.2	2.8	2.15	4.85	5.55	9.3	10.0	7.15	5.6	5.6	5.6
29	3.9	.....	2.7	2.25	4.8	4.45	9.45	11.55	7.25	5.6	5.7	5.55
30	3.9	.....	2.6	2.3	4.75	4.35	9.75	12.2	7.15	5.55	5.8	5.5
31	3.9	.....	2.5	.....	4.8	.....	11.05	12.0	.....	5.65	.....	5.45

RIO GRANDE NEAR BROWNSVILLE, TEX.

This station was established in 1900 by the International (Water) Boundary Commission. It is about 1 mile above Brownsville, Tex., and in front of Matamoros, Tamaulipas, and 960 miles by river below El Paso. The conditions at the station are described in Water-Supply Paper No. 174, page 81.

Discharge measurements of Rio Grande near Brownsville, Tex., in 1906.

[By P. Guerra.]

Date.	Area of section.	Gage height.	Discharge.	Date.	Area of section.	Gage height.	Discharge.
	Sq. ft.	*Feet.*	*Sec.-ft.*		*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 3	3,906	7.1	9,840	July 9	4,097	8.9	18,265
January 7	3,497	6.4	8,122	July 12	5,763	13.2	28,275
January 11	3,132	5.6	6,601	July 16	5,988	13.8	30,314
January 15	2,986	5.1	6,234	July 20	5,823	13.4	31,296
January 19	2,803	4.7	5,885	July 24	6,118	14.1	34,765
January 23	2,705	4.4	5,588	July 28	6,118	14.1	34,797
January 27	2,558	4.0	5,168	August 1	6,166	14.2	35,564
January 30	2,454	3.7	4,887	August 5	5,986	13.8	24,799
February 3	2,426	3.6	4,765	August 9	5,986	13.8	26,051
February 7	2,526	4.0	5,161	August 13	6,071	14.0	26,804
February 11	2,592	4.2	5,352	August 17	6,060	14.0	25,794
February 15	2,491	3.9	5,033	August 21	6,096	14.1	26,469
February 19	2,998	5.5	7,340	August 25	6,060	14.0	25,626
February 23	3,396	6.6	8,363	August 29	6,108	14.1	26,671
February 27	3,787	7.7	10,405	September 2	6,071	14.0	25,573
March 3	3,751	7.6	9,863	September 6	6,108	14.1	28,078
March 7	3,199	6.2	7,459	September 10	6,071	14.0	25,673
March 11	2,920	5.1	6,053	September 14	5,948	13.7	24,318
March 15	2,704	4.4	5,479	September 18	5,286	12.0	19,161
March 19	2,542	3.8	4,745	September 22	5,058	11.4	18,168
March 24	2,290	3.1	4,202	September 26	5,975	13.8	24,742
March 28	2,147	2.7	3,873	September 30	5,254	11.9	18,889
April 1	2,001	2.3	3,490	October 3	4,858	10.7	17,246
April 5	1,879	1.9	3,163	October 7	4,785	10.5	16,848
April 10	1,806	1.6	2,917	October 11	4,540	8.7	11,280
April 14	1,844	1.7	3,086	October 15	4,327	8.1	10,491
April 19	1,886	2.0	3,245	October 19	4,434	8.4	11,130
April 23	1,887	2.0	3,248	October 23	4,038	7.4	9,750
April 27	2,711	4.4	5,429	October 27	3,900	7.0	9,075
May 1	2,115	2.7	4,015	October 31	3,852	6.7	8,703
May 5	1,992	2.4	3,569	November 3	3,488	6.7	7,842
May 9	2,292	3.3	4,498	November 7	3,374	6.5	7,566
May 13	2,067	2.6	3,837	November 11	3,337	6.4	7,388
May 17	2,191	3.0	4,195	November 15	3,186	6.2	7,300
May 21	3,310	6.5	11,427	November 19	3,081	5.9	6,879
May 26	3,725	7.6	14,650	November 23	3,058	5.7	6,797
May 31	2,904	5.1	6,434	November 27	3,062	5.8	6,802
June 4	2,187	5.2	6,814	November 30	3,084	5.9	6,870
June 8	3,522	7.5	12,386	December 3	3,011	5.9	6,922
June 12	2,366	5.5	7,849	December 7	2,978	5.8	6,776
June 16	2,352	5.3	7,484	December 11	2,999	5.7	6,678
June 20	2,781	4.5	5,634	December 15	3,049	5.7	6,659
June 24	2,822	4.6	5,748	December 19	3,251	6.6	8,045
June 28	2,901	4.8	6,137	December 23	3,226	6.5	7,915
July 1	2,157	5.1	6,622	December 27	3,123	6.2	7,441
July 5	3,368	6.6	11,563	December 31	2,937	5.6	6,858

Daily gage height, in feet, of Rio Grande near Brownsville, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.35	3.6	7.9	2.3	2.65	5.2	5.4	14.2	14.0	11.4	6.8	6.0
2	7.2	3.6	7.85	2.2	2.55	5.2	4.65	14.15	14.0	11.05	6.8	6.0
3	7.1	3.6	7.5	2.1	2.5	5.2	4.5	14.15	14.0	10.55	6.75	5.9
4	6.95	3.5	7.05	2.0	2.45	5.2	4.7	14.0	14.05	10.05	6.7	5.85
5	6.8	3.5	6.85	1.9	2.4	5.3	6.0	13.7	14.1	9.85	6.6	5.8
6	6.65	3.65	6.5	1.8	2.4	5.35	7.9	12.85	14.05	10.15	6.5	5.8
7	6.45	4.05	6.25	1.7	3.1	7.15	7.3	12.45	13.95	10.45	6.5	5.8
8	6.25	4.5	5.9	1.7	3.35	7.6	5.85	13.15	13.9	10.0	6.4	5.8
9	5.95	4.5	5.55	1.6	3.25	7.85	7.9	13.65	14.0	9.15	6.4	5.8
10	5.75	4.35	5.35	1.6	2.85	5.85	12.5	14.0	14.0	8.95	6.4	5.7
11	5.65	4.2	5.15	1.6	2.65	5.65	13.1	14.0	14.0	8.75	6.4	5.7
12	5.5	4.1	4.95	1.65	2.6	5.5	13.25	14.0	14.1	8.55	6.4	5.6
13	5.4	4.0	4.75	1.7	2.6	5.5	13.4	14.0	13.95	8.35	6.35	5.6
14	5.25	4.0	4.55	1.7	2.75	5.5	13.55	14.0	13.75	8.25	6.3	5.6
15	5.1	3.9	4.35	1.7	3.2	5.4	13.7	14.0	13.55	8.05	6.2	5.7
16	5.0	3.8	4.2	1.7	3.0	5.25	13.75	14.0	13.25	7.85	6.15	6.1
17	4.9	3.8	4.05	1.9	3.05	5.05	13.8	14.0	12.55	7.8	6.05	6.3
18	4.8	4.15	3.9	2.55	3.15	4.95	13.75	14.05	11.9	8.05	5.95	6.4
19	4.7	5.3	3.8	2.2	3.2	4.65	13.65	14.1	11.5	8.4	5.9	6.6
20	4.6	6.15	3.7	2.0	3.3	4.45	13.45	14.1	11.15	8.05	5.8	6.7

Daily gage height, in feet, of Rio Grande near Brownsville, Tex., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	4.55	6.45	3.55	2.05	5.65	4.25	13.3	14.05	11.1	7.9	5.8	6.7
22	4.5	6.5	3.4	2.0	8.6	4.2	13.5	14.0	11.4	7.7	5.7	6.55
23	4.4	6.6	3.25	2.0	6.9	4.35	13.75	14.0	11.4	7.4	5.7	6.45
24	4.25	6.6	3.1	2.1	5.3	4.5	14.05	14.0	11.9	7.3	5.7	6.4
25	4.1	6.9	2.95	4.1	7.5	4.75	14.1	14.0	13.6	7.15	5.7	6.3
26	4.05	7.45	2.85	4.75	7.3	4.9	14.1	14.0	13.85	7.0	5.7	6.2
27	4.0	7.7	2.75	4.4	5.6	4.65	14.1	14.0	13.8	6.95	5.75	6.15
28	3.9	7.6	2.65	3.85	4.75	4.75	14.1	14.1	13.55	6.9	5.8	5.95
29	3.8	.....	2.5	3.4	4.5	6.05	14.1	14.05	12.55	6.8	5.9	5.75
30	3.7	.....	2.45	3.0	4.8	6.75	14.15	14.0	11.8	6.7	5.9	5.6
31	3.6	.....	2.4	.....	5.15	.....	14.2	14.0	.....	6.7	.....	5.6

SALADO RIVER DRAINAGE BASIN.

RIO SALADO NEAR GUERRERO, TAMAULIPAS, MEXICO.

This station was established in 1900 by the International (Water) Boundary Commission. The Salado is a torrential stream entering the Rio Grande from the Mexican side about 60 miles below Laredo, or 730 miles by river below El Paso. The town of Guerrero is located on the Salado some 4 miles above its mouth, and the gaging station is 2 miles above the town. The conditions at the station are described in Water-Supply Paper No. 174, page 84.

Discharge measurements of Rio Salado near Guerrero, Tamaulipas, Mexico, in 1906.

[By D. de Lassaulx.]

Date.	Area of section.	Gage height.	Discharge.	Date.	Area of section.	Gage height.	Discharge.
	Sq. ft.	*Feet.*	*Sec.-ft.*		*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 1	1,128	2.5	358	June 1	826	1.0	114
January 5	1,115	2.4	334	June 5	73	0.6	[a] 45
January 9	1,099	2.3	308	June 9	72	0.3	[a] 33
January 14	1,075	2.2	295	June 13	72	0.0	[a] 20
January 18	1,074	2.2	296	June 18	62	−0.1	[a] 15
January 22	1,053	2.1	244	June 23	74	0.1	[a] 27
January 27	1,031	1.9	203	June 28	54	−0.4	[a] 12
February 1	1,030	1.9	210	July 3	55	−0.4	[a] 13
February 5	1,248	3.0	528	July 7	1,374	3.8	1,042
February 9	1,109	2.3	313	July 8	3,141	12.0	14,792
February 13	1,095	2.3	299	July 19	2,350	6.2	3,037
February 17	1,059	2.2	268	July 21	2,389	6.4	3,336
February 21	1,062	2.2	271	July 25	2,437	6.5	3,725
February 25	1,060	2.2	287	July 29	2,302	5.9	2,700
March 1	1,051	2.1	245	August 2	2,371	6.2	3,114
March 6	1,006	1.9	209	August 6	2,357	6.1	2,913
March 11	982	1.8	181	August 10	2,246	5.7	2,570
March 16	969	1.7	165	August 14	2,338	6.0	2,875
March 20	956	1.6	146	August 18	2,259	5.5	2,334
March 24	938	1.5	143	August 22	2,291	5.6	2,706
March 28	923	1.4	138	August 26	2,290	5.7	2,779
April 2	887	1.3	125	August 29	2,616	7.2	4,856
April 6	865	1.2	123	September 2	2,393	6.2	3,134
April 10	868	1.2	120	September 6	2,555	6.6	3,990
April 14	849	1.1	110	September 10	2,549	6.6	3,981
April 18	851	1.1	110	September 14	2,469	6.6	3,913
April 22	1,101	2.3	331	September 18	2,335	6.1	2,922
April 26	990	1.7	181	September 22	2,333	6.1	2,958
May 1	871	1.2	127	September 23	2,597	7.3	5,060
May 6	850	1.1	114	September 26	2,364	6.2	3,192
May 10	906	1.4	136	September 29	2,300	5.9	2,772
May 14	836	1.0	113	October 3	2,259	5.6	2,566
May 19	889	1.3	131	October 7	2,194	5.5	2,415
May 21	1,268	3.3	685	October 11	2,165	5.2	2,008
May 24	1,256	3.3	676	October 15	2,149	5.1	1,956
May 28	860	1.2	125	October 19	2,102	5.0	1,928

[a] Taken at rocks.

Discharge measurements of Rio Salado near Guerrero, Tamaulipas, Mexico, in 1906—Continued.

Date.	Area of section.	Gage height.	Discharge.	Date.	Area of section.	Gage height.	Discharge.
	Sq. ft.	*Feet.*	*Sec.-ft.*		*Sq. ft.*	*Feet.*	*Sec.-ft.*
October 23	2,123	5.0	1,951	November 29	1,984	4.3	1,216
October 26	2,102	4.9	1,867	December 3	1,971	4.3	1,226
October 29	2,084	4.8	1,784	December 7	1,950	4.2	1,014
November 2	2,089	4.8	1,793	December 11	1,942	4.1	1,026
November 6	2,054	4.7	1,686	December 15	1,954	4.1	1,008
November 10	2,052	4.6	1,670	December 19	1,956	4.1	1,005
November 14	2,025	4.5	1,479	December 23	1,946	4.1	991
November 18	1,989	4.4	1,287	December 26	1,921	4.0	903
November 22	2,002	4.4	1,320	December 29	1,896	3.9	832
November 26	1,976	4.3	1,204				

Daily gage height, in feet, of Rio Salado, near Guerrero, Tamaulipas, Mexico, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.5	1.9	2.05	1.4	1.2	1.0	−0.4	6.2	6.1	5.6	4.8	4.3
2	2.5	1.95	2.0	1.3	1.2	0.9	−0.4	6.15	6.15	5.6	4.75	4.3
3	2.5	2.25	2.0	1.3	1.15	0.75	−0.45	6.15	6.05	5.6	4.7	4.3
4	2.45	2.6	2.0	1.3	1.1	0.65	0.6	6.25	7.0	5.6	4.7	4.3
5	2.4	2.9	2.0	1.3	1.1	0.55	1.15	6.25	6.45	5.5	4.7	4.2
6	2.4	2.55	1.9	1.3	1.1	0.45	3.0	6.1	6.55	5.5	4.7	4.2
7	2.4	2.45	1.85	1.2	1.0	0.4	6.3	6.0	6.2	5.45	4.6	4.2
8	2.3	2.35	1.8	1.2	1.0	0.3	12.95	5.85	6.7	5.4	4.6	4.2
9	2.3	2.3	1.8	1.25	1.25	0.25	15.65	5.75	6.9	5.4	4.6	4.2
10	2.3	2.3	1.8	1.2	1.35	0.2	16.75	5.65	6.55	5.3	4.6	4.2
11	2.3	2.3	1.8	1.2	1.2	0.1	14.95	5.6	6.5	5.2	4.6	4.1
12	2.3	2.3	1.75	1.2	1.15	0.1	13.65	5.75	6.35	5.2	4.5	4.1
13	2.3	2.3	1.7	1.1	1.1	0.0	13.1	6.1	6.75	5.2	4.5	4.1
14	2.2	2.3	1.7	1.1	1.0	0.0	7.65	5.8	6.5	5.2	4.5	4.1
15	2.2	2.3	1.7	1.0	1.0	−0.05	6.7	5.65	6.45	5.1	4.5	4.1
16	2.2	2.3	1.7	1.0	0.9	−0.1	6.6	5.6	6.4	5.1	4.45	4.1
17	2.2	2.2	1.6	1.0	0.9	−0.15	6.45	5.5	6.25	5.2	4.4	4.1
18	2.2	2.2	1.6	1.1	1.0	−0.2	6.2	5.5	6.1	5.1	4.4	4.1
19	2.2	2.2	1.6	1.2	1.3	−0.05	6.3	6.0	6.65	5.0	4.4	4.1
20	2.1	2.2	1.6	1.2	2.7	0.2	6.35	6.15	6.25	5.0	4.4	4.1
21	2.1	2.2	1.6	1.4	3.2	0.25	6.55	6.3	6.1	5.0	4.4	4.1
22	2.05	2.2	1.5	2.9	3.1	0.15	7.3	5.6	6.25	5.0	4.4	4.1
23	2.0	2.2	1.5	2.75	4.0	0.05	6.95	5.85	7.05	5.0	4.3	4.0
24	1.95	2.2	1.5	2.2	3.6	−0.1	6.7	5.9	6.7	4.9	4.3	4.0
25	1.9	2.2	1.5	1.85	2.3	−0.2	6.45	5.75	6.6	4.9	4.3	4.0
26	1.9	2.1	1.5	1.6	1.7	−0.3	6.25	5.7	6.15	4.9	4.3	4.0
27	1.9	2.4	1.5	1.45	1.35	−0.4	6.1	5.6	6.0	4.9	4.3	4.0
28	1.9	2.15	1.4	1.35	1.15	−0.35	6.0	5.95	5.9	4.8	4.3	4.0
29	1.9	.....	1.4	1.25	0.95	−0.3	5.85	6.9	5.85	4.8	4.3	3.9
30	1.9	.....	1.4	1.2	0.8	−0.4	5.7	6.95	5.75	4.8	4.3	3.9
31	1.9	.....	1.4	.....	0.7	.....	5.95	6.3	.....	4.8	.....	3.9

SAN JUAN RIVER DRAINAGE BASIN.

RIO SAN JUAN NEAR SANTA ROSALIA RANCH, TAMAULIPAS, MEXICO.

This station was established in 1900 by the International (Water) Boundary Commission. The San Juan is a long torrential stream entering the Rio Grande 15 miles below Roma and 790 miles by river below El Paso. Six miles above its mouth is the town of Camargo. The station was first placed 12 miles above Camargo, but in time of heavy flood in the Rio Grande backwater reached the station, and on July 14, 1902, it was moved 6 miles farther

upstream to its present location. It is now above backwater. The conditions at the station are described in Water-Supply Paper No. 174, page 87.

Discharge measurements of Rio San Juan near Santa Rosalia Ranch, Tamaulipas, Mexico, in 1906.

[By S. Jaso.]

Date.	Area of section.	Gage height.	Discharge.	Date.	Area of section.	Gage height.	Discharge.
	Sq. ft.	*Feet.*	*Sec.-ft.*		*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 4	577	3.5	487	August 11	346	2.7	310
January 9	494	3.2	374	August 14	257	2.1	146
January 14	471	3.1	317	August 17	203	1.7	81
January 19	430	2.9	259	August 19	648	4.45	1,347
January 23	391	2.7	211	August 20	3,600	20.0	16,080
January 27	375	2.6	187	August 23	1,055	6.7	2,430
January 31	369	2.5	171	August 26	652	4.45	947
February 4	979	5.8	1,711	August 28	1,962	11.65	5,642
February 8	577	3.6	510	August 29	844	5.55	1,623
February 12	548	3.5	477	September 1	509	3.65	560
February 16	498	3.2	401	September 4	853	5.55	1,644
February 20	480	3.1	347	September 6	1,586	9.65	4,560
February 25	488	3.2	366	September 7	2,236	13.6	7,223
February 27	700	4.75	994	September 10	693	4.75	1,286
March 3	626	4.0	660	September 13	476	3.55	554
March 8	541	3.4	426	September 16	356	2.8	290
March 13	494	3.2	359	September 19	351	2.8	293
March 20	415	2.6	250	September 21	488	3.75	592
March 24	416	2.6	233	September 22	401	3.3	446
March 28	399	2.5	196	September 23	1,011	7.4	2,339
March 31	358	2.3	149	September 24	3,132	21.0	9,804
April 5	339	2.1	107	September 25	3,476	22.6	12,166
April 10	319	2.0	125	September 28	936	6.85	2,284
April 14	275	1.7	72	October 1	732	4.9	1,219
April 19	271	1.7	79	October 4	789	4.95	1,330
April 22	2,457	12.5	5,968	October 5	1,063	6.6	2,272
April 23	1,345	7.25	2,826	October 7	679	4.5	966
April 27	720	4.4	877	October 10	549	3.85	610
May 3	514	3.25	412	October 13	486	3.6	499
May 8	418	2.65	245	October 16	492	3.55	492
May 14	394	2.4	203	October 17	693	4.6	1,012
May 19	749	4.5	887	October 19	608	4.1	726
May 24	465	3.0	311	October 22	476	3.4	424
May 28	365	2.25	147	October 25	436	3.15	373
May 31	308	1.9	111	October 28	429	3.0	339
June 4	256	1.5	78	October 30	697	4.65	976
June 8	236	1.3	59	October 31	581	3.95	648
June 12	226	1.2	28	November 6	477	3.4	450
June 16	212	1.1	18	November 9	591	4.0	675
June 20	591	3.7	529	November 15	485	3.6	354
June 25	928	5.45	1,834	November 18	468	3.3	288
June 27	745	4.55	1,079	November 21	393	3.0	203
July 2	278	1.7	53	November 24	401	3.0	217
July 5	2,320	12.6	6,499	December 3	441	3.1	236
July 9	375	2.65	220	December 6	429	3.0	298
July 10	1,110	6.8	2,434	December 9	415	3.0	337
July 14	403	2.75	284	December 12	410	2.9	293
July 19	299	2.15	136	December 13	750	4.75	1,004
July 23	464	3.35	464	December 15	546	3.8	533
July 27	395	2.85	311	December 19	483	3.4	411
July 30	299	2.2	153	December 22	479	3.35	401
July 31	698	4.6	1,119	December 25	459	3.2	366
August 2	1,148	6.9	2,266	December 28	432	3.1	319
August 5	442	3.2	394	December 31	410	2.9	267
August 8	847	5.4	1,865				

Daily gage height, in feet, of Rio San Juan near Santa Rosalia Ranch, Tamaulipas, Mexico, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.5	2.5	4.8	2.2	3.55	1.75	1.85	2.9	3.65	5.0	3.65	3.05
2	3.45	2.6	4.3	2.2	3.35	1.7	1.65	4.75	3.4	4.7	3.5	3.1
3	3.4	2.8	3.95	2.2	3.25	1.6	1.45	5.6	5.0	4.55	3.45	3.1
4	3.45	5.8	3.75	2.1	3.2	1.5	9.65	3.95	5.7	4.75	3.4	3.1
5	3.3	4.6	3.6	2.1	3.05	1.45	9.4	3.25	3.6	6.05	3.4	3.0
6	3.2	3.8	3.5	2.1	2.9	1.4	5.2	2.95	12.6	5.15	3.45	3.0
7	3.2	3.65	3.5	2.1	2.8	1.4	3.75	2.5	13.0	4.45	3.85	3.0
8	3.2	3.6	3.4	2.1	2.65	1.3	3.4	3.6	6.5	4.15	4.0	3.0
9	3.2	3.55	3.4	2.05	2.6	1.3	2.55	4.1	4.9	3.95	3.95	3.0
10	3.15	3.5	3.3	2.0	2.55	1.3	4.5	2.85	4.65	3.85	3.85	3.0
11	3.1	3.5	3.3	1.9	2.5	1.25	5.2	3.1	4.0	3.7	3.7	3.0
12	3.1	3.5	3.2	1.85	2.4	1.2	4.1	2.9	3.55	3.6	3.6	2.95
13	3.1	3.5	3.2	1.8	2.4	1.2	3.25	2.3	3.4	3.6	3.6	4.9
14	3.1	3.4	3.1	1.7	2.4	1.15	2.7	2.1	3.2	3.5	3.6	4.15
15	3.1	3.25	3.0	1.7	2.4	1.1	2.4	1.9	2.95	3.45	3.6	3.8
16	3.0	3.2	2.9	1.6	2.4	1.1	2.3	1.8	2.75	3.5	3.5	3.65
17	2.9	3.1	2.8	1.7	2.3	1.0	2.45	1.7	2.6	4.35	3.4	3.5
18	2.9	3.1	2.7	1.7	3.85	1.0	2.5	2.0	2.45	4.6	3.3	3.4
19	2.9	3.1	2.7	1.7	4.7	1.0	2.1	3.8	2.8	4.05	3.2	3.4
20	2.8	3.1	2.65	1.7	4.3	3.4	1.85	19.8	3.1	3.7	3.1	3.4
21	2.8	3.7	2.7	2.3	3.05	2.7	2.8	17.75	3.6	3.6	3.0	3.4
22	2.7	3.55	2.7	9.2	2.5	2.3	3.65	9.85	4.4	3.35	3.0	3.35
23	2.7	3.35	2.6	8.4	2.85	1.9	3.3	6.35	7.3	3.3	3.0	3.3
24	2.6	3.3	2.6	6.1	3.15	1.6	2.9	5.25	20.0	3.2	3.0	3.3
25	2.6	3.2	2.6	5.2	2.9	3.95	2.6	4.8	21.8	3.15	3.0	3.2
26	2.6	3.2	2.5	4.7	2.7	2.9	2.45	4.45	11.85	3.1	3.0	3.2
27	2.6	4.4	2.5	4.35	2.45	4.4	2.85	4.5	8.85	3.1	2.9	3.15
28	2.6	5.25	2.5	4.15	2.25	3.25	2.65	9.2	6.95	3.0	3.1	3.1
29	2.6	.....	2.4	3.95	2.05	2.45	2.35	5.65	6.15	2.95	3.1	3.05
30	2.6	.....	2.35	3.75	1.95	1.95	2.15	4.55	5.55	4.5	3.1	3.0
31	2.5	.....	2.3	.....	1.85	.....	4.2	3.85	.....	3.9	.....	2.9

PECOS RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Pecos River rises in the northeastern part of New Mexico and flows in a general southerly direction through the southeastern part of that Territory, crossing the western prolongation of Texas, and finally entering the Rio Grande at a point about one-third way up from the mouth of that stream. It is supplied to a considerable extent by water from large springs in the limestone rocks of the region. These maintain the perennial flow of the river, the run-off from the catchment basin being irregular in character and diminishing at times to a relatively small amount.

Large irrigation works which have been constructed in the vicinity of Roswell utilize the greater part of the summer flow of the river, so that during the dry season of the year little water crosses the Texas line. Between Carlsbad and the Texas State line there are several reenforcing springs. The water that flows in the stream is largely derived from the seepage of irrigated lands above and is often heavily charged with alkaline salts. Irrigation canals have been constructed along the valley in Texas, principally near the town of Pecos, at the crossing of the Texas and Pacific Railroad. The most important of these is the Margueretta canal system. The valley is fertile, and where properly irrigated large crops are produced.

PECOS RIVER AT SANTA ROSA, N. MEX.

This station was established May 5, 1903. It was originally located at the bridge of the Chicago, Rock Island and Pacific Railway, but was moved later in the year to a point 335 feet above the railway bridge. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 93, where are given also references to publications that contain data for previous years.

Discharge measurements of Pecos River at Santa Rosa, N. Mex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 8	E. Patterson	32	12	0.55	12
April 12	do	78	77	1.70	288
April 12	do	87	87	1.85	349
April 13	do	87	93	1.82	333
April 30	J. M. Giles	88	106	2.00	498
April 30	do	88	111	2.00	490
May 30	E. Patterson	90	101	2.00	423
May 30	do	90	102	1.95	392
June 29	do	20	10	.95	18
July 22	J. M. Giles	77	78	1.45	240
July 22	do	77	62	1.35	183
July 23	do	63	50	1.30	125
July 23	do	94	156	2.35	832
July 23	do	94	136	2.15	676
July 24	do	76	85	1.70	348
August 13	do	62	50	1.30	88
October 27 [a]	William A. Lamb	18	14	1.02	23

[a] Measured by wading.

Daily gage height, in feet, of Pecos River at Santa Rosa, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.6	0.6	0.6	1.6	1.9	2.0	0.8	1.7	0.9	1.3	1.1	1.5
2	.6	.6	.5	1.6	1.9	2.0	.8	1.4	.95	1.1	1.2	1.4
3	.6	.6	.5	1.6	1.9	2.0	2.5	2.3	.95	1.0	1.2	1.5
4	.6	.6	.6	1.6	2.0	2.0	1.5	1.4	.95	1.0	1.2	1.4
5	.6	.6	.5	1.7	2.0	2.0	1.3	1.6	.85	1.0	1.2	1.4
6	.6	.6	.5	1.7	2.0	2.0	.8	1.7	1.3	1.4	1.3	2.5
7	.6	.6	.5	1.7	2.0	1.9	1.5	1.9	1.1	1.5	1.3	2.1
8	.6	.5	.5	1.7	2.0	1.9	1.5	1.6	.95	1.4	1.2	1.9
9	.6	.5	.5	1.7	2.0	2.0	1.5	3.6	.85	1.3	1.2	1.7
10	.6	.5	.5	1.6	2.3	2.0	2.0	1.6	.85	1.2	1.2	1.6
11	.6	.6	.5	1.7	2.5	2.0	3.0	1.7	.85	1.2	1.2	1.7
12	.6	.6	.5	1.8	2.5	2.0	2.0	1.4	.85	1.2	1.2	1.5
13	.6	.6	.5	1.9	2.5	4.5	2.0	1.4	.85	1.1	1.2	1.5
14	.6	.6	.5	1.8	2.3	2.0	1.3	1.3	.85	1.1	1.1	1.4
15	.6	.6	.5	1.8	2.2	2.0	1.3	1.2	.9	1.1	1.1	1.4
16	.6	.6	.5	1.7	2.2	2.0	1.3	1.0	.85	1.0	1.1	1.4
17	.6	.6	.5	1.8	2.3	2.0	2.0	0.95	.85	1.1	1.1	1.3
18	.6	.6	.5	1.8	2.2	2.0	3.0	.9	.9	1.1	1.1	.9
19	.6	.6	.5	1.8	2.2	1.8	2.0	.9	.9	1.1	.85	.85
20	.6	.6	.5	1.9	2.2	1.8	2.0	.85	.85	1.0	.85	.85
21	.6	.6	.5	2.1	2.2	1.6	1.7	.85	.85	.9	1.2	.85
22	.6	.6	.5	2.0	2.2	1.6	1.4	.85	.85	.85	1.2	.85
23	.6	.6	.5	2.0	2.2	1.2	2.5	.9	.85	.85	1.2	1.0
24	.6	.6	.5	2.0	2.0	1.2	1.5	.9	.85	.85	1.2	.9
25	.6	.5	.5	2.2	2.0	1.0	1.5	.9	.85	1.1	1.2	.9
26	.6	.5	.5	2.2	2.0	1.2	1.2	.95	.95	1.1	1.1	.9
27	.6	.6	.5	2.0	2.0	1.0	1.1	.95	1.1	9	1.2	.85
28	.6	.6	.5	2.0	2.0	.8	1.3	.95	1.0	.85	1.3	.85
29	.6	.....	.5	2.0	2.0	.6	1.2	.95	1.3	1.0	1.2	.85
30	.6	.....	1.1	2.0	2.0	.6	1.2	.95	1.2	1.1	1.3	.85
31	.6	.....	1.1	.....	2.0	.....	2.0	.9	.....	1.1	.....	.85

Daily discharge in second-feet of Pecos River at Santa Rosa, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	14	14	14	250	425	423	12	320	15	88	36	160
2	14	14	10	250	425	423	12	160	18	36	58	120
3	14	14	10	250	425	423	950	740	18	22	58	160
4	14	14	14	250	480	460	245	165	18	22	58	120
5	14	14	10	288	480	460	145	260	13	22	58	120
6	14	14	10	288	480	460	12	300	88	120	88	810
7	14	14	10	288	480	395	245	425	36	160	88	520
8	14	10	10	288	480	395	245	240	18	120	58	380
9	14	10	10	288	480	460	245	1,750	13	88	58	260
10	14	10	10	250	700	460	570	240	13	58	58	205
11	14	14	10	288	830	490	1,370	280	13	58	58	260
12	14	14	10	325	830	490	570	128	13	58	58	160
13	14	14	10	370	830	2,470	570	128	13	36	58	160
14	14	14	10	325	680	490	145	88	13	36	36	120
15	14	14	10	325	603	490	145	58	15	36	36	120
16	14	14	10	275	603	490	145	22	13	22	36	120
17	14	14	10	335	680	490	570	18	13	36	36	88
18	14	14	10	335	603	530	1,370	15	15	36	36	15
19	14	14	10	335	585	390	570	15	15	36	13	13
20	14	14	10	410	585	390	570	13	13	22	13	13
21	14	14	10	550	585	270	365	13	13	15	58	13
22	14	14	10	475	585	270	195	13	13	13	58	13
23	14	14	10	475	585	80	950	15	13	13	58	22
24	14	14	10	485	440	80	245	15	13	13	58	15
25	14	10	10	620	440	32	245	15	13	36	58	15
26	14	10	10	620	440	100	100	18	18	36	36	15
27	14	14	10	485	423	32	50	18	36	15	58	13
28	14	14	10	495	423	12	125	18	22	13	88	13
29	14	.....	10	495	423	6	85	18	88	22	58	13
30	14	.....	85	495	423	6	85	18	58	36	88	13
31	14	.....	85	.....	423	.....	535	15	.....	36	.....	13

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Pecos River at Santa Rosa, N. Mex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	14	14	14	861
February	14	10	13.3	739
March	85	10	15.1	928
April	620	250	374	22,300
May	830	423	544	33,400
June	2,470	6	399	23,700
July	1,370	12	377	23,200
August	1,750	13	179	11,000
September	88	13	22.4	1,330
October	160	13	43.9	2,700
November	88	13	53.9	3,210
December	810	13	132	8,120
The year	2,470	6	181	131,000

NOTE.—Values are rated as follows: January to March and August to December, approximate; April to July, fair.

PECOS RIVER NEAR FORT SUMNER, N. MEX.

This station was established June 12, 1904, by Earl Patterson. It is located about 12 miles northwest of Fort Sumner, N. Mex., and 45 miles south of Santa Rosa, N. Mex., the nearest railway station. It was originally located 1 mile upstream from the spring, trees, and houses known as Arinosa, but was relocated July 5, 1905, near the

spring. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 95, where are given also references to publications that contain data for previous years.

Discharge measurements of Pecos River near Fort Sumner, N. Mex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 11	E. Patterson	108	70	1.68	84
March 27	do	120	73	1.60	81
April 10	do	169	132	1.94	309
May 9	do	188	208	2.25	628
May 17	do	185	171	2.13	596
May 31	do	190	181	2.05	462
June 8	do	184	152	2.04	374
June 19	do	122	121	2.00	299
June 29	do	133	59	1.65	85
July 6	do	131	86	1.81	209
July 7	J. M. Giles	134	89	1.74	182
July 9	do	200	398	2.55	2,140
July 9	do	200	460	2.65	2,650
July 9	do	200	407	2.40	1,970
July 10	do	190	396	2.30	1,480
July 25	do	105	128	2.10	320
August 11	do	122	123	1.95	335
August 12	do	134	121	2.05	400
September 11	Wm. A. Lamb	116	63	1.89	88
October 29	do	120	66	1.90	106

Daily gage height, in feet, of Pecos River near Fort Sumner, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.40	1.70	1.65	1.80	1.95	2.05	1.70	2.10	1.92	2.00	1.92	2.10
2	2.45	1.75	1.65	1.85	2.05	2.20	1.62	2.02	1.95	2.02	1.95	2.02
3	2.50	1.75	1.60	1.80	1.95	2.05	2.25	2.12	1.95	2.05	1.95	2.00
4	2.30	1.70	1.60	1.95	1.95	2.25	2.58	2.22	2.02	1.98	1.95	2.02
5	2.20	1.75	1.65	1.95	2.05	2.10	1.92	2.28	2.00	2.18	1.92	2.05
6	2.30	1.75	1.65	1.95	2.00	2.00	1.88	2.38	2.00	2.02	1.92	2.50
7	2.35	1.75	1.65	1.95	2.05	2.10	1.72	2.05	1.92	2.10	1.90	2.32
8	2.20	1.80	1.70	1.90	2.20	2.00	2.85	2.00	2.00	2.00	1.95	2.02
9	2.05	1.80	1.70	1.90	2.00	2.00	2.62	2.48	1.95	2.02	1.90	2.05
10	2.20	1.75	1.70	1.90	2.15	2.10	2.22	2.02	2.00	2.02	1.92	2.12
11	1.85	1.75	1.70	1.95	2.20	2.10	1.92	1.98	1.92	2.00	1.92	2.02
12	1.80	1.75	1.65	2.00	2.25	2.10	2.28	1.92	1.90	2.00	1.90	2.02
13	1.70	1.80	1.65	2.05	2.30	2.35	2.18	1.90	1.98	1.98	1.85	1.98
14	1.70	1.70	1.65	2.10	2.30	2.40	1.78	1.92	2.00	1.88	1.82	2.00
15	1.70	1.70	1.70	2.10	2.25	2.05	1.92	1.90	2.00	1.70	1.85	2.05
16	1.70	1.70	1.65	1.95	2.30	2.00	1.92	1.90	1.95	1.82	1.88	2.10
17	1.70	1.70	1.60	1.95	2.15	2.00	1.68	1.90	1.92	1.80	1.80	2.15
18	1.65	1.70	1.70	2.05	2.20	2.05	1.90	1.82	1.98	1.82	1.80	2.10
19	1.60	1.75	1.70	2.00	2.15	2.00	2.02	1.80	1.95	1.80	1.88	2.15
20	1.70	1.70	1.70	1.95	2.25	2.05	2.02	1.80	2.00	1.82	.88	2.08
21	1.70	1.65	1.75	2.00	2.30	2.00	1.92	1.80	2.00	1.88	1.88	2.02
22	1.65	1.65	1.70	1.95	2.25	1.95	1.92	1.85	2.00	1.80	1.88	1.98
23	1.75	1.65	1.70	2.05	2.25	1.90	2.02	1.92	2.65	1.80	1.85	1.95
24	1.75	1.70	1.65	2.10	2.25	1.90	2.22	1.95	1.95	1.80	1.80	2.00
25	1.75	1.70	1.65	2.05	2.20	1.85	2.10	2.02	1.90	1.80	1.82	1.95
26	1.70	1.65	1.60	2.20	2.10	1.80	1.98	1.98	1.90	1.85	1.88	1.92
27	1.70	1.65	1.60	2.10	2.00	1.80	2.00	1.90	2.00	1.92	1.95	1.90
28	1.75	1.65	1.70	2.05	2.10	1.75	1.98	1.95	1.92	1.90	1.95	1.90
29	1.75	.....	1.70	2.00	2.00	1.70	2.00	1.95	1.95	1.90	1.95	1.95
30	1.80	.....	1.75	2.00	2.00	1.70	1.95	1.90	1.90	1.92	2.00	1.92
31	1.75	.....	1.80	.....	2.05	.....	1.90	1.92	.....	1.90	.....	1.95

Daily discharge, in second-feet, of Pecos River near Fort Sumner, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,600	130	68	220	240	460	115	425	150	170	120	280
2	1,820	165	68	245	350	720	70	320	175	190	140	200
3	2,050	165	40	198	240	440	940	450	175	220	140	180
4	1,290	130	40	360	240	800	2,100	630	240	155	140	200
5	980	165	68	360	350	500	325	760	220	360	120	225
6	1,290	165	68	340	290	340	280	1,130	220	190	120	1,000
7	1,460	165	68	340	320	480	182	410	150	270	106	590
8	980	210	95	280	540	330	3,600	345	170	170	140	200
9	610	210	95	265	265	330	2,470	1,470	130	190	106	225
10	980	165	95	265	460	455	1,200	430	170	190	120	300
11	320	165	95	345	590	455	480	370	110	170	120	200
12	270	165	68	385	680	455	1,410	250	100	180	106	200
13	170	210	68	460	860	970	890	230	155	165	75	165
14	170	130	73	540	860	1,100	230	250	170	95	60	180
15	170	130	110	495	800	370	390	230	170	50	75	225
16	170	130	73	298	920	305	390	200	130	60	95	280
17	170	130	50	298	640	305	100	200	110	60	60	340
18	130	130	120	420	740	365	290	135	155	60	60	280
19	100	165	120	350	640	300	440	120	130	60	95	340
20	170	130	120	298	860	360	440	120	170	60	95	260
21	170	95	158	350	1,000	330	225	120	170	95	95	200
22	130	95	132	298	860	270	225	160	170	60	95	165
23	215	95	132	380	860	220	335	220	1,440	60	75	140
24	215	130	98	460	860	240	490	210	130	60	60	180
25	215	130	98	380	740	195	320	280	100	60	60	140
26	170	95	81	630	540	170	195	240	100	80	95	120
27	170	68	81	460	390	170	215	165	170	120	140	106
28	215	68	150	380	540	135	235	210	110	106	140	106
29	215	.....	150	320	390	115	250	210	130	106	140	140
30	210	.....	172	290	390	115	205	165	100	120	180	120
31	165	.....	220	.....	460	.....	160	150	.....	106	.....	140

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Pecos River near Fort Sumner, N. Mex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	2,050	100	548	33,700
February	210	68	140	7,780
March	220	40	99.2	6,100
April	630	198	357	21,200
May	1,000	240	578	35,500
June	1,100	115	393	23,400
July	3,600	70	619	38,100
August	1,470	120	342	21,000
September	1,440	103	194	11,500
October	360	50	130	7,990
November	180	60	106	6,310
December	1,600	106	240	14,800
The year	3,600	40	312	227,000

NOTE. Values are rated as follows: January to April and August to December, approximate; May to July, fair.

PECOS RIVER NEAR ROSWELL, N. MEX.

This station was established April 24, 1903, and was discontinued June 30, 1906. It is located at the highway bridge 8 miles southeast of Roswell, N. Mex., and about 200 feet below the mouth of Hondo River. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 97, where are given also references to publications that contain data for previous years.

Discharge measurements of Pecos River near Roswell, N. Mex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 14	E. Patterson	193	351	2.70	537
January 29	do	178	281	2.50	337
January 30	do	126	212	2.48	314
February 8	J. M. Giles	97	201	2.42	266
February 14	E. Patterson	160	256	2.60	310
February 23	do	129	199	2.40	254
March 5	do	111	169	2.25	202
March 15	do	104	118	1.90	69
March 29	do	75	72	2.00	94
April 7	do	218	461	3.60	782
April 7	E. C. Murphy	236	591	3.14	1,140
April 8	E. Patterson	130	331	2.80	575
April 25	J. M. Giles	142	269	2.83	483
April 30	E. Patterson	133	298	3.00	539
May 5	do	130	183	2.80	398
May 14	do	146	284	3.26	686
May 19	do	124	257	3.12	529
June 11	do	180	187	2.89	283
June 16	do	228	303	3.42	777

Daily gage height and discharge of Pecos River near Roswell, N. Mex., for 1906.

Day.	January.		February.		March.		April.		May.		June.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1	2.4	275	2.5	335	2.3	220	2.0	94	2.9	460	2.9	330
2	2.4	275	2.5	335	2.3	220	2.0	94	2.9	460	2.9	330
3	2.4	275	2.5	335	2.2	170	2.0	94	2.9	470	3.5	930
4	2.4	275	2.5	335	2.2	170	2.0	94	2.7	325	3.3	650
5	2.4	275	2.5	335	2.2	170	2.0	94	2.7	325	3.1	460
6	2.4	275	2.5	335	2.2	170	2.2	170	2.8	400	3.1	460
7	2.5	335	2.4	275	2.2	170	3.0	830	2.8	370	2.8	260
8	2.5	335	2.4	275	2.2	170	2.7	500	2.8	370	2.7	200
9	2.5	335	2.4	275	2.2	170	2.6	415	3.4	960	2.7	190
10	2.5	335	2.4	275	2.2	170	2.4	275	3.2	700	2.7	190
11	2.6	415	2.4	275	2.2	170	2.4	250	3.1	590	2.9	300
12	2.6	415	2.4	275	2.2	170	2.4	250	3.0	470	2.9	300
13	2.7	500	2.4	275	2.2	170	2.4	250	3.0	470	2.9	300
14	2.7	500	2.5	335	2.0	94	2.4	250	3.7	1,380	3.0	380
15	2.7	500	2.5	335	2.0	94	2.4	250	3.3	740	3.9	1,600
16	2.7	500	2.5	335	1.9	69	2.6	360	3.2	620	3.4	770
17	2.6	415	2.5	335	1.9	69	2.8	520	3.2	620	3.2	550
18	2.6	415	2.5	335	1.9	69	2.8	520	3.2	620	3.0	380
19	2.5	335	2.5	335	1.9	69	3.0	730	3.3	720	3.5	890
20	2.4	275	2.5	335	1.9	69	3.0	680	3.4	850	3.2	550
21	2.4	275	2.5	335	1.9	69	3.0	680	3.2	615	2.8	250
22	2.4	275	2.4	275	1.9	69	2.8	480	3.3	720	2.7	200
23	2.4	275	2.4	275	1.9	69	3.0	680	3.3	700	2.6	150
24	2.4	275	2.4	275	2.0	94	3.0	650	3.3	700	2.5	110
25	2.4	275	2.3	220	2.0	94	2.8	460	3.3	700	2.5	110
26	2.5	335	2.3	220	2.0	94	2.8	460	3.2	590	2.5	110
27	2.5	335	2.3	220	2.0	94	2.8	415	3.1	500	2.5	110
28	2.5	335	2.3	220	2.0	94	3.0	580	3.1	500	2.7	200
29	2.5	335	.....	.....	2.0	94	3.0	580	3.0	400	2.5	170
30	2.5	335	.....	.....	2.0	94	2.9	460	3.0	400	2.5	110
31	2.5	335	.....	.....	2.0	94	.....	.....	3.0	400	.....	.....

NOTE.—The discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Pecos River near Roswell, N. Mex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	500	275	343	21,100
February	335	220	297	16,500
March	220	69	123	7,560
April	830	94	406	24,200
May	1,380	325	585	36,000
June	1,600	110	385	22,900
The period				128,000

NOTE.—Values are rated as good.

PECOS RIVER NEAR DAYTON, N. MEX.

This station was established March 24, 1905, about 3 miles east of Dayton, N. Mex., 100 feet below the mouth of Penasco River and about 6 miles above McMillan dam at Lakewood, N. Mex. The gage was washed out September 6, 1905, and the station was relocated September 7, 1905, about one-half mile upstream. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 99.

Discharge measurements of Pecos River near Dayton, N. Mex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 11	E. Patterson	106	242	2.75	428
January 16	do	112	275	3.10	594
January 22	J. M. Giles	88	216	2.52	329
January 22	do	88	223	2.57	358
February 1	E. Patterson	98	222	2.85	397
February 13	J. M. Giles	94	212	2.80	394
February 13	do	105	234	2.95	466
February 20	E. Patterson	82	202	2.65	350
February 27	J. M. Giles	78	176	2.40	295
March 3	do	77	171	2.40	278
March 17	E. Patterson	61	112	1.80	119
March 20	do	61	112	1.77	131
March 24	do	61	118	1.85	142
March 29	J. M. Giles	64	122	1.80	150
April 5	Murphy and Giles	61	139	2.15	201
April 20	J. M. Giles	171	373	3.62	730
May 1	E. Patterson	162	295	3.38	544
May 4	do	121	251	3.08	441
May 10	J. M. Giles	147	274	3.20	499
May 15	E. Patterson	161	329	3.68	713
June 6	do	122	290	3.47	429
June 12	do	118	196	2.73	258
June 15	do	120	189	2.66	264
June 27	J. M. Giles	121	151	2.35	174
July 12	do	173	674	4.53	1,510
July 12	do	173	600	4.36	1,370
July 13	do	127	472	4.05	1,040
July 28	do	113	189	2.80	266
August 8	do	121	282	3.50	510
September 5	do	58	94	1.84	95
October 30	William A. Lamb	100	148	2.50	197

Daily gage height, in feet, of Pecos River near Dayton, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.5	2.7	2.4	1.7	3.5	3.0	2.1	2.2	2.4	2.2	2.5	4.0
2	2.9	2.7	2.4	1.7	3.3	3.0	2.1	2.0	2.0	2.4	2.5	4.7
3	2.5	2.7	2.4	1.7	3.3	3.2	2.1	2.5	1.9	2.4	2.5	4.5
4	2.6	2.7	2.4	2.1	3.1	4.0	2.0	2.6	1.9	2.3	3.4	4.3
5	2.7	2.7	2.4	2.1	3.0	3.3	2.0	3.0	1.8	2.2	2.9	4.0
6	2.5	2.7	2.3	3.7	2.9	3.4	3.65	3.4	1.8	2.2	2.9	3.8
7	2.5	2.6	2.3	3.6	2.9	3.6	3.7	3.4	1.8	2.4	2.9	3.5
8	2.6	2.5	2.3	3.6	2.8	3.2	3.3	2.6	1.7	2.4	2.9	3.4
9	2.5	2.5	2.3	3.6	3.0	3.1	3.2	2.9	1.9	2.4	2.9	4.3
10	2.5	2.6	2.3	3.4	3.2	2.7	2.9	3.1	1.8	2.4	2.9	4.3
11	2.8	2.6	2.3	3.1	3.4	3.0	5.0	3.0	1.8	2.4	2.9	4.0
12	3.0	2.7	2.3	2.8	3.5	2.9	4.6	3.9	1.7	2.4	2.9	4.0
13	2.9	2.7	2.2	2.6	3.4	2.9	4.1	3.7	1.7	2.4	2.9	3.9
14	3.4	2.7	2.3	2.7	3.5	2.8	3.7	3.4	1.6	2.7	2.9	3.7
15	2.9	2.7	2.0	2.8	3.6	2.7	4.0	3.0	1.7	2.6	2.9	3.4
16	3.4	2.7	1.9	3.3	3.8	2.7	3.6	3.0	1.7	2.7	2.9	3.4
17	2.9	2.7	1.8	3.5	3.8	2.7	4.6	2.7	1.8	2.8	2.9	3.6
18	3.1	2.7	1.8	3.5	3.7	2.7	5.8	2.6	1.8	2.6	2.9	3.8
19	3.1	2.7	1.8	3.5	3.6	2.7	3.7	2.5	2.2	2.4	3.2	3.5
20	3.1	2.7	1.8	3.5	3.5	2.7	3.8	2.4	2.6	2.4	3.5	3.5
21	2.8	2.6	1.8	3.5	3.5	2.7	3.6	2.2	2.4	2.4	3.5	3.4
22	2.5	2.4	1.8	3.8	3.5	2.7	3.4	2.1	2.2	2.4	3.5	3.2
23	2.7	2.5	1.8	3.6	3.8	2.7	3.1	2.2	2.2	2.5	3.4	2.9
24	2.7	2.5	1.8	3.4	4.0	2.7	2.8	2.0	2.0	2.5	3.3	3.4
25	2.7	2.4	1.9	3.4	4.0	2.7	2.7	2.2	2.1	2.5	3.3	3.0
26	2.7	2.4	1.9	3.4	4.0	2.7	2.0	2.4	2.1	2.6	3.4	3.0
27	2.6	2.5	1.9	3.4	4.0	2.5	3.2	2.5	2.1	2.5	3.9	3.0
28	2.6	2.4	1.8	3.4	3.6	2.4	2.8	2.6	2.4	2.7	4.0	3.4
29	2.6	.....	1.8	3.4	3.6	2.3	2.6	3.0	2.3	2.6	3.9	3.1
30	2.6	.....	1.8	3.5	3.2	2.2	2.0	2.3	2.3	2.5	3.8	3.2
31	2.6	.....	1.8	.....	3.0	.....	3.1	2.6	.....	2.5	.....	3.3

Daily discharge, in second-feet, of Pecos River near Dayton, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	325	365	290	145	640	310	148	150	175	140	195	760
2	500	365	280	145	515	310	148	112	112	175	195	1,230
3	325	365	278	145	515	3.0	148	195	100	175	195	1,080
4	365	365	278	190	440	1,000	141	217	100	157	470	950
5	410	365	278	190	420	400	141	324	90	140	295	760
6	325	365	250	780	385	425	685	468	90	140	295	650
7	325	335	250	730	385	475	725	468	90	175	295	510
8	365	315	250	730	350	360	455	217	83	175	295	470
9	325	315	250	730	420	330	405	293	100	175	295	950
10	325	335	250	630	500	250	295	357	90	175	295	950
11	450	335	250	500	575	310	2,030	324	90	175	295	750
12	540	365	250	385	625	285	1,600	760	83	175	295	760
13	500	365	225	315	575	285	1,090	612	83	175	295	705
14	750	365	250	350	625	260	725	470	77	240	295	600
15	500	365	160	385	675	260	990	324	83	217	295	480
16	750	365	142	585	815	260	645	324	83	240	295	480
17	500	365	131	680	815	260	1,600	240	90	268	295	560
18	600	365	131	680	740	260	3,000	217	90	217	295	650
19	600	365	131	680	675	260	725	195	140	175	393	510
20	600	365	131	680	615	260	810	175	217	175	510	510
21	450	335	131	680	615	260	645	140	175	175	510	470
22	325	295	131	830	615	260	510	125	140	175	510	395
23	410	315	131	725	815	260	365	140	140	195	470	295
24	410	315	131	560	1,000	260	265	112	112	195	430	470
25	410	295	150	560	1,000	260	240	140	125	195	430	325
26	410	295	150	560	1,000	260	140	175	125	217	470	325
27	365	315	150	560	1,000	215	405	195	125	195	700	325
28	365	295	150	560	675	190	268	217	175	240	760	470
29	365	.....	150	560	675	175	215	324	158	217	700	357
30	365	.....	150	640	400	165	240	157	158	195	650	393
31	365	.....	150	.....	310	.....	140	217	.....	195	.....	430

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Estimated monthly discharge of Pecos River near Dayton, N. Mex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	750	325	439	27,000
February	365	295	342	19,000
March	290	131	194	11,900
April	830	145	530	31,500
May	1,000	310	626	38,500
June	1,000	165	308	18,300
July	3,000	140	643	39,500
August	760	112	270	16,600
September	217	77	117	6,960
October	268	140	190	11,700
November	760	195	391	23,300
December	1,230	325	599	36,800
The year	3,000	77	387	281,000

PECOS RIVER AT LAKEWOOD, N. MEX.

This station was established January 11, 1906, for the purpose of comparing the amount of water available at the McMillan reservoir with that below the Avalon dam. It shows the flow discharged from the gates of the dam, but does not include the discharge from the spillway nor any leakage from the reservoir. It is located 3 miles southeast of Lakewood and one-half mile below McMillan dam.

The channel is straight for 200 feet above and 300 feet below the gaging section. There is but one channel at all stages. Both banks are high. The bed of the river is of rock and is permanent.

Discharge measurements are made from a cable and car. The initial point for soundings is the frame supporting the cable on the right bank.

The gage was first placed at the lower side of the head-gates and gave the depth of water above the sill of the gates. It was found unsatisfactory, because the velocity was influenced by the varying head in the lake, and on February 8 a new gage was established near the lower end of the outlet canal. This gage was affected by wave action, and on May 8 was moved to about midway between the McMillan dam and the cable. This gage consists of an inclined scale fastened to the stakes, reading from 0 to 5 feet, and was read during 1906 by H. C. Holcomb. The bench mark consists of three nails driven in the pudding-stone bed rock, 38 feet below the gage; elevation, 0.67 foot above gage datum.

Discharge measurements of Pecos River at Lakewood, N. Mex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 11	J. M. Giles	74	198	[a] 9.50	698
January 11	do	74	195	[a] 9.50	645
January 25	E. Patterson	81	205	[a] 8.90	701
February 7	J. M. Giles	74	171	[b] 3.35	477
February 7	E. Patterson	78	188	[b] 3.35	534
February 14	J. M. Giles	74	198	[b] 3.50	684
February 20	E. Patterson	80	174	[b] 3.30	415
February 22	do	74	151	[b] 3.05	308
March 3	J. M. Giles	77	147	[b] 3.05	290
March 20	E. Patterson	22	11	[b] 1.50	5.6
April 2	Brent S. Drane			[b] 1.53	6.5
April 8	do			[b] 1.49	4.0
April 11	do			[b] 1.42	3.0
April 14	do			[b] 1.38	2.0
April 21	J. M. Giles	80	325	[b] 4.30	1,160
May 8	do	10	10	[c] 0.30	31
June 5	E. Patterson	76	185	[c] 2.05	459
July 13	J. M. Giles	82	413	[c] 4.50	1,720
October 30	William A. Lamb	4	2.4	[b] 1.56	7.9
November 30	do	78	308	[c] 2.95	917

[a] Gage at head-gates. [b] Gage at lower end of outlet canal. [c] Lower gage.

Daily gage height, in feet, of Pecos River at Lakewood, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		8.9	3.2	1.5	3.65	0.3	0.3	0.2	0.2	0.2	0.2	3.9
2		8.9	3.2	1.53	3.6	.3	.3	.2	.2	.2	.2	4.6
3		8.8	3.0	1.53	3.6	.3	.3	.2	.2	.2	.2	4.75
4		8.8	3.1	1.51	3.55	.3	.3	.2	.2	.2	.2	4.8
5		8.7	3.1	1.51	3.45	2.0	.3	.2	.2	.2	.2	4.5
6		8.7	1.5	[a] 1.5	2.7	2.35	.3	.2	.2	.2	.2	4.1
7		9.0	1.5	1.5	2.0	2.7	.3	.2	.2	.2	.2	3.5
8		3.4	1.5	[a] 1.49	0.3	2.65	.3	.2	.2	.2	.2	2.6
9		3.3	1.5	1.48	.3	3.2	.3	.2	.2	.2	.2	2.35
10		3.4	1.5	[a] 1.48	.3	3.0	.3	.2	.2	.2	.2	3.15
11	9.5	3.4	1.5	[a] 1.42	.3	2.7	2.5	1.8	.2	.2	.2	3.0
12	9.5	3.6	1.5	1.42	.3	2.2	4.05	2.65	.2	.2	.2	2.8
13	9.4	3.5	1.5	1.41	.3	.65	4.4	2.65	.2	.2	.2	2.6
14	9.0	3.6	1.5	1.38	.3	.25	4.3	2.6	.2	.2	.2	2.45
15	8.9	3.6	1.5	[a] 1.37	.3	.25	4.0	2.5	.2	.2	.2	2.4
16	9.4	3.6	1.5	[a] 1.36	.3	.25	3.8	2.4	.2	.2	.2	2.3
17	9.5	3.5	1.5	1.35	.3	.3	3.8	2.2	.2	.2	.2	0.1
18	9.4	3.5	1.5	1.35	.3	.3	4.2	2.0	.2	.2	.2	.1
19	9.2	3.4	1.5	2.3	2.0	.3	4.7	0.2	.2	.2	.2	.1
20	9.1	3.4	1.5	4.3	2.85	.3	4.5	.2	.2	.2	.2	.1
21	9.0	3.4	1.5	4.3	2.85	.3	3.85	.2	.2	.2	.2	.1
22	9.0	3.4	1.5	4.25	2.85	.3	3.0	.2	.2	.2	.2	.1
23	8.9	3.3	1.5	4.2	2.8	.3	0.4	.2	.2	.2	.2	.1
24	8.9	3.2	1.5	4.1	3.25	.3	.4	.2	.2	.2	1.6	.1
25	9.0	3.2	1.5	4.05	3.2	.3	.15	.2	.2	.2	1.6	.1
26	8.9	3.2	1.5	4.0	3.15	.3	.2	.2	.2	.2	1.6	.1
27	8.9	3.1	1.5	3.9	3.1	.3	.2	2.8	.2	.2	1.6	.1
28	8.9	3.1	1.5	3.8	0.3	.3	.2	4.2	.2	.2	2.4	.1
29	8.8		1.5	3.75	.3	.3	.2	3.75	.2	.2	3.0	.1
30	8.9		1.5	3.7	.3	.3	.2	2.8	.2	.2	3.8	.1
31	8.9		1.5		.3		.2	.2		.2		.1

[a] Estimated.

NOTE.—The gates of Lake McMillan were closed from March 6 to April 19, inclusive. There was no flow past the gage except leakage from the gates. The flow of the river escaped through "gyp-holes" along the eastern shore of the lake. The gates were also closed at other times after May 28, as indicated by the low gage heights.

Rating table for Pecos River at Lakewood, N. Mex.

FEBRUARY 8, 1906, TO MAY 7, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.35	2.0	2.00	58	2.60	182	3.20	400	3.80	755
1.40	2.5	2.10	74	2.70	210	3.30	450	3.90	830
1.50	5.0	2.20	91	2.80	241	3.40	505	4.00	910
1.60	10	2.30	110	2.90	275	3.50	560	4.10	990
1.70	19	2.40	132	3.00	313	3.60	620	4.20	1,075
1.80	30	2.50	156	3.10	355	3.70	685	4.30	1,160
1.90	43								

MAY 8, 1906, TO DECEMBER 31, 1906.[b]

0.10	10	0.90	135	1.70	355	2.50	675	3.60	1,210
0.20	20	1.00	155	1.80	390	2.60	720	3.80	1,320
0.30	30	1.10	180	1.90	425	2.70	765	4.00	1,430
0.40	45	1.20	205	2.00	465	2.80	810	4.20	1,540
0.50	60	1.30	230	2.10	505	2.90	855	4.40	1,660
0.60	75	1.40	260	2.20	545	3.00	905	4.60	1,780
0.70	95	1.50	290	2.30	585	3.20	1,005	4.80	1,900
0.80	115	1.60	320	2.40	630	3.40	1,105		

[a] This table is based on twelve discharge measurements made during 1906 and is fairly well defined.
[b] This table is applicable only for open-channel conditions. It is based on four discharge measurements made during 1906 and is fairly well defined.

Monthly discharge of Pecos River at Lakewood, N. Mex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
February 8–28	620	355	500	20,800
March	400	5	62.9	3,870
April	1,160	2	351	20,900
May	1,030	30	370	22,800
June	1,000	25	216	12,900
July	1,840	15	560	34,400
August	1,540	20	314	19,300
September	20	20	20.0	1,190
October	20	20	20.0	1,230
November	1,320	20	153	9,100
December	1,900	10	582	35,800
The period				182,000

NOTE.—Values are rated as follows: February to August and December, good; November, fair. Results for September and October and all other low periods after May 1 are liable to large errors. See measurement made October 30.

LEAKAGE FROM LAKE M'MILLAN.

Measurements were made during 1906 to determine the leakage through the "gyp holes" in the bed of Lake McMillan.

Measurements of leakage from Lake McMillan, near Lakewood, N. Mex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.[a]	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 5	E. C. Murphy	29	50	13.7	115
May 8	J. M. Giles	7.6	3.5	12.6	5
June 27	do	80	168	15.05	121
July 28	do	45	82	14.1	114

[a] Of Lake McMillan.

PECOS RIVER AT AVALON, N. MEX.

This station was established January 6, 1906, just below the Avalon dam, about 6 miles north of Carlsbad, N. Mex. The discharge at this point includes that at Lakewood, the flow of certain springs between the stations, the discharge of the spillways of the McMillan dam, and that portion of the leakage through the gypsum in the bottom of the reservoir[a] that returns to the river above Avalon. The figures show that the gain was 85 second-feet on April 7, just after the closing of the gates of Lake McMillan, and increased to nearly 150 second-feet from May 9 to 16. This increase was probably caused by the rise of the water in the reservoir.

The channel is straight for some distance above and below the station, and the current is moderate except at high water. The right bank is high; the left is low and liable to overflow. The bed of the river is of firm earth and loose rock and is permanent.

Measurements are made from a boat held in place by a one-fourth-inch cable. The initial point for soundings is a post on the left bank to which a tagged wire is fastened.

The gage is a scale fastened to stakes driven in the right bank, and is located about a half mile south of the dam. It was read during 1906 by J. D. McAninch. The bench mark is a permanent B. M. of the survey of the Carlsbad project, 5 feet east of the post, 1 mile south of the head-gates of the main canal, on its right bank; elevation, 3,164 feet above sea level and 26.74 feet above gage datum.

Discharge measurements of Pecos River at Avalon, N. Mex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 7	E. Patterson	125	445	1.50	488
January 12	J. M. Giles	125	497	1.72	651
January 13	do	125	487	1.65	575
January 22	E. Patterson	125	428	1.42	414
January 24	do	121	429	1.42	421
February 20	J. M. Giles	128	454	1.45	470
February 23	do	128	456	1.35	408
February 26	do	128	454	1.30	375
March 2	do	128	462	1.32	376
March 3	E. Patterson	125	430	1.25	337
March 21	do	115	353	.72	136
March 29[b]	J. M. Giles	52	70	.78	151
April 3	E. Patterson	52	70	.79	157
April 6[a]	Lamb and Giles	53	74	.85	157
April 23	J. M. Giles	143	604	2.32	1,260
May 7	do	56	75	.80	148
May 9	do	56	72	.76	131
June 5	E Patterson	125	486	1.62	563
June 11	do	140	526	1.98	884
July 14	J. M. Giles	150	652	2.75	1,690
July 15	do	150	647	2.60	1,610
September 6	do	59	68	.70	124
October 3	William A. Lamb	58	77	.80	163

[a] See Third Annual Report of the Reclamation Service, pp. 386–392.
[b] Measurement made by wading.

Daily gage height, in feet, of Pecos River at Avalon, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	1.45	1.3	0.8	1.9	1.0	0.9	.....	1.5
2	.....	1.45	1.3	.8	1.8	1.0	.9	.....	1.4
3	.....	1.45	1.3	.8	1.8	1.9	.9	.....	1.4
4	.....	1.45	1.3	.8	1.7	1.7	.9	.....	1.2
5	.....	1.4	1.3	.8	1.6	1.65	.9	.....	1.0
6	1.5	1.4	1.3	.8	1.6	1.7	.9	.....	.9
7	1.45	1.4	0.5	2.0	.85	2.0	.95	.....	.8
8	1.5	1.4	.5	.8	.8	2.0	.95	.....	.8
9	1.5	1.45	.5	.8	.75	2.7	.95	0.9	.7
10	1.6	1.45	.5	.8	.75	2.0	.95	.9	.7
11	1.7	1.45	.5	.8	.8	1.9	.95	1.3	.7
12	1.7	1.5	.5	.8	.8	1.85	2.5	2.2	.7
13	1.7	1.5	.6	.8	.85	.9	2.8	2.0	.6
14	1.7	1.5	.6	.8	.85	.9	2.8	2.0	.7
15	1.7	1.5	.6	.8	.85	.9	2.75	2.0	1.0
16	1.6	1.5	.6	.8	.85	.85	2.7	2.0	.....
17	1.6	1.5	.6	.9	.85	.85	5.6	1.8	.....
18	1.6	1.5	.7	.9	1.6	.85	2.7	1.6	.....
19	1.6	1.5	.7	1.3	1.55	.85	2.7	1.6	.....
20	1.6	1.5	.7	1.5	2.0	.85	2.6	1.0	.....
21	1.5	1.5	.7	1.6	2.0	.85	1.2	1.0	.....
22	1.5	1.5	.7	2.5	2.0	.85	1.15	.9	.....
23	1.45	1.4	.7	2.3	2.0	.9	1.1	.9	.....
24	1.45	1.4	.7	2.3	2.3	.85	1.0	.9	.....
25	1.45	1.3	.7	2.2	2.2	.9	.95	.8	.....
26	1.45	1.3	.7	2.2	2.2	.9	.9	.8	.....
27	1.45	1.3	.8	2.1	2.15	.9	.9	.9	.....
28	1.45	1.3	.8	2.1	2.1	1.0	.9	2.8	.....
29	1.45	.....	.8	1.9	1.1	1.0	.9	2.3	.....
30	1.45	.....	.8	1.9	1.0	.9	.9	2.0	.....
31	1.45	.....	.8	.....	1.0	.....	.9	1.6	.....

NOTE.—For conditions at Lake McMillan affecting the flow at this station see footnote to gage heights at Lakewood, p. —.

Rating table for Pecos River at Avalon, N. Mex., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.50	90	1.30	365	2.10	1,005	2.90	1,890	4.40	3,865
0.60	105	1.40	425	2.20	1,105	3.00	2,010	4.60	4,155
0.70	125	1.50	490	2.30	1,210	3.20	2,255	4.80	4,450
0.80	150	1.60	560	2.40	1,320	3.40	2,505	5.00	4,750
0.90	180	1.70	635	2.50	1,430	3.60	2,760	5.20	5,050
1.00	215	1.80	720	2.60	1,540	3.80	3,030	5.40	5,350
1.10	260	1.90	810	2.70	1,655	4.00	3,300	5.60	5,650
1.20	310	2.00	905	2.80	1,770	4.20	3,580		

NOTE.—The above table is based on twenty-three discharge measurements made during 1906 and is well defined between gage heights 0.7 foot and 2.75 feet.

Monthly discharge of Pecos River at Avalon, N. Mex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January 6-31	635	458	522	26,900
February	490	365	450	25,000
March	365	90	165	10,100
April	1,430	150	487	29,000
May	1,210	138	535	32,900
June	1,660	165	408	24,300
July	5,650	180	751	46,200
August 9-31	1,770	150	573	26,100
September 1-15	490	105	219	6,520
The period	.....	.....	.....	227,000

NOTE.—Values are rated as follows: January, February, and April to August, excellent; March and September, good.

PECOS RIVER AT CARLSBAD, N. MEX.

This station was established May 20, 1903, at the Green Street Bridge, Carlsbad, N. Mex., and is about 500 feet below the station of the Pecos Valley and Northeastern Railway and 2,000 feet below the Hagerman power dam. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 102, where are given also references to publications that contain data for previous years.

Discharge measurements of Pecos River at Carlsbad, N. Mex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 26	E. Patterson	89	190	1.55	529
February 6[a]	do	90	192	1.49	451
February 19[a]	J. M. Giles	90	204	1.57	529
March 21	E. Patterson	88	136	1.10	198
April 4	do	88	144	1.15	217
April 5	do	88	142	1.14	206
October 7[b]	V. T. Sullivan			0.00	18

[a] Measured from boat. [b] Estimated.

Daily gage height, in feet, of Pecos River at Carlsbad, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.69	1.55	1.34	1.13	2.02	1.24	1.23	1.18	1.08	1.08	1.10	2.40
2	1.68	1.55	1.35	1.14	1.95	1.25	1.23	1.18	1.05	1.08	1.10	2.68
3	1.66	1.55	1.35	1.15	1.85	1.26	1.24	1.19	1.05	1.08	1.10	3.20
4	1.64	1.54	1.35	1.15	1.79	1.29	1.24	1.20	1.05	1.08	1.10	3.20
5	1.61	1.50	1.34	1.16	1.74	2.10	1.24	1.20	1.05	1.08	1.11	3.15
6	1.58	1.50	1.33	1.34	1.56	2.22	1.25	1.21	1.05	1.07	1.11	2.78
7	1.58	1.54	1.10	1.17	1.05	2.30	1.30	1.22	1.02	0.00	1.11	2.60
8	1.58	1.54	1.04	1.17	1.09	2.32	1.25	1.22	1.00	1.01	1.11	2.32
9	1.57	1.53	1.00	1.17	1.10	2.35	1.25	1.23	1.03	1.06	1.11	2.55
10	1.54	1.52	0.98	1.16	1.11	2.33	1.25	1.23	1.03	1.07	1.12	2.28
11	1.58	1.53	.96	1.15	1.12	2.28	1.25	1.24	1.03	1.08	1.12	2.20
12	1.71	1.54	.96	1.15	1.14	2.12	2.30	1.97	1.02	1.08	1.12	2.18
13	1.69	1.58	.97	1.15	1.16	1.54	3.15	2.04	1.03	1.08	1.12	2.00
14	1.65	1.60	.97	1.15	1.17	1.24	3.05	2.00	1.04	1.08	1.13	1.95
15	1.64	1.60	.98	1.15	1.18	1.22	2.75	1.98	1.03	1.08	1.13	1.90
16	1.62	1.60	.98	1.15	1.18	1.18	2.60	1.95	1.03	1.08	1.13	1.82
17	1.62	1.60	1.01	1.16	1.19	1.17	5.00	1.92	1.03	1.09	1.13	1.04
18	1.60	1.59	1.04	1.15	1.22	1.22	2.75	1.88	1.03	1.09	1.13	1.04
19	1.58	1.58	1.06	1.18	1.50	1.23	3.30	1.44	1.03	1.09	1.13	1.04
20	1.58	1.58	1.07	1.40	1.80	1.32	3.25	1.09	1.03	1.09	1.13	1.05
21	1.56	1.56	1.08	2.69	2.00	1.24	2.95	1.05	1.03	1.10	1.13	1.05
22	1.56	1.54	1.09	2.64	2.11	1.25	2.70	1.05	1.03	1.10	1.13	1.06
23	1.55	1.52	1.10	2.59	2.17	1.24	2.20	1.05	1.03	1.09	1.19	1.06
24	1.55	1.48	1.10	2.55	2.42	1.25	1.28	1.05	1.03	1.09	1.50	1.06
25	1.55	1.51	1.11	2.47	2.52	1.25	1.20	1.05	1.05	1.10	1.50	1.08
26	1.55	1.46	1.11	2.40	2.35	1.23	1.20	1.05	1.08	1.10	1.52	1.08
27	1.55	1.43	1.12	2.33	2.35	1.38	1.20	1.05	1.08	1.10	1.55	1.09
28	1.55	1.37	1.12	2.26	1.28	1.23	1.20	2.92	1.08	1.10	1.65	1.09
29	1.55	.....	1.12	2.18	1.20	1.25	1.19	2.75	1.08	1.10	1.88	1.10
30	1.55	.....	1.13	2.10	1.20	1.23	1.18	2.20	1.08	1.10	2.28	1.10
31	1.55	.....	1.13	.....	1.21	.....	1.18	1.40	.....	1.10	.....	1.11

Rating table for Pecos River at Carlsbad, N. Mex., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.00	18	0.90	155	1.70	610	2.50	1,275	3.60	2,340
0.10	24	1.00	190	1.80	690	2.60	1,360	3.80	2,610
0.20	31	1.10	230	1.90	770	2.70	1,445	4.00	2,900
0.30	40	1.20	275	2.00	850	2.80	1,530	4.20	3,220
0.40	51	1.30	330	2.10	935	2.90	1,615	4.40	3,570
0.50	65	1.40	390	2.20	1,020	3.00	1,700	4.60	3,940
0.60	80	1.50	455	2.30	1,105	3.20	1,890	4.80	4,350
0.70	100	1.60	530	2.40	1,190	3.40	2,100	5.00	4,800
0.80	125								

NOTE.—The above table is based on discharge measurements made during 1903–1906 and is well defined.

Monthly discharge of Pecos River at Carlsbad, N. Mex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	618	485	528	32,500
February	530	372	482	26,800
March	360	176	240	14,800
April	1,440	244	580	34,500
May	1,290	210	552	33,900
June	1,150	262	511	30,400
July	4,800	266	884	54,400
August	1,630	210	499	30,700
September	222	190	207	12,300
October	230	[a]18	217	13,300
November	1,090	230	327	19,500
December	1,890	206	744	45,700
The year	4,800	18	481	349,000

[a] Low minimum caused by shutting off of water at power dam above for one day.

NOTE.—Values are rated as good.

PECOS RIVER AND MARGUERETTA FLUME NEAR PECOS, TEX.

This station was established January 1, 1898, about 6 miles above Pecos, Tex., at the flume of the Barstow Irrigation Company (old Margueretta Canal Company). The canal diverts the water from Pecos River 3 miles above the flume from the west side of the river. The water, except about 10 second-feet taken by the West Valley ditch, is carried across to the east side by a timber flume supported on pile bents. The river gage was lowered 1.0 foot March 22, 1906. All gage heights for 1906 refer to the new datum. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 105, where are given also references to publications that contain data for previous years.

Discharge measurements of Pecos River near Pecos, Tex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 1	J. M. Giles	86	319	2.50	593
February 9	E. Patterson	132	292	2.45	587
March 2	do	132	223	2.08	442
March 22	do	75	71	0.70	71
April 6	do	78	65	0.75	78
May 2	J. M. Giles	140	281	2.90	653
May 11	E. Patterson	70	113	1.30	131
June 7	J. M. Giles	62	86	1.30	125
June 8	do	62	87	1.31	126
June 8	do	67	92	1.38	143
June 13	E. Patterson	135	268	2.95	640
June 14	do	135	253	2.80	578
July 16	J. M. Giles	175	520	4.40	1,450
October 6	William A. Lamb	60	73	1.20	114
December 13	do	173	375	3.95	1,120

Daily gage height, in feet, of Pecos River near Pecos, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.5	2.4	2.1	0.7	3.0	1.4	0.8	1.2	3.3	1.3	1.3	3.6
2	2.6	2.4	2.0	.7	2.9	1.3	.8	1.2	2.2	1.3	1.3	3.6
3	2.6	2.4	2.0	.7	2.8	3.1	.6	1.1	1.9	1.3	1.3	4.6
4	2.6	2.3	2.0	.7	2.7	3.2	.6	1.0	1.4	1.3	1.3	5.0
5	2.6	2.4	2.0	.7	2.6	2.0	.7	2.1	1.3	1.3	1.3	5.2
6	2.6	2.4	1.9	.8	2.3	1.3	1.4	1.8	1.1	1.2	1.3	5.0
7	2.6	2.4	1.7	.8	2.3	1.55	1.4	1.6	1.1	1.3	1.3	4.7
8	2.6	2.3	1.7	.9	2.2	2.35	1.3	1.3	1.1	1.3	1.3	4.7
9	2.6	2.4	1.7	2.0	1.8	2.75	1.4	1.3	1.1	1.2	1.4	4.4
10	2.6	2.4	1.5	1.4	1.7	2.7	1.5	1.2	1.1	1.2	1.4	3.8
11	2.6	2.4	1.4	.9	1.2	3.0	1.5	1.5	1.1	0.9	1.4	3.5
12	2.6	2.4	1.4	.8	1.2	3.2	1.5	1.4	.9	.9	1.5	3.9
13	2.7	2.4	1.2	.8	1.2	2.95	1.5	1.2	.9	.9	1.5	3.85
14	2.7	2.5	1.2	.8	1.1	2.75	2.9	1.2	.9	.9	1.5	3.7
15	2.7	2.5	1.2	.7	1.1	2.35	4.3	2.8	.9	1.5	1.5	3.5
16	2.7	2.5	1.0	.7	1.1	2.0	4.4	2.8	.9	1.5	1.5	3.4
17	2.7	2.5	1.0	.7	1.0	1.45	4.3	2.8	.9	1.4	1.5	3.4
18	2.7	2.5	0.9	.8	.9	1.3	5.75	2.8	.9	1.4	1.5	3.4
19	2.7	2.5	.8	.9	.9	1.3	4.9	2.7	.9	1.3	1.5	2.7
20	2.8	2.5	.8	1.4	.9	1.15	4.7	2.6	.9	1.4	1.5	2.4
21	2.8	2.5	.7	2.0	.9	1.05	4.8	2.2	.9	1.4	1.5	2.15
22	2.8	2.5	.7	1.4	1.2	.9	4.6	1.5	.9	1.4	1.5	1.95
23	2.7	2.5	.7	3.3	2.5	.9	4.2	1.3	.9	1.4	1.7	1.9
24	2.6	2.5	.7	3.6	2.75	.9	3.7	1.1	.8	1.4	1.9	1.9
25	2.6	2.4	.7	3.6	2.8	.9	2.7	1.1	.8	1.4	1.8	1.8
26	2.5	2.4	.6	3.5	2.8	.8	2.1	1.1	.8	1.4	1.8	1.8
27	2.4	2.3	.7	3.5	3.5	.6	2.0	1.9	.8	1.4	1.9	1.8
28	2.4	2.1	.7	3.4	3.4	.6	1.7	1.6	1.4	1.4	2.6	1.8
29	2.4	.....	.7	3.3	3.3	1.4	1.6	1.1	1.5	1.4	2.6	1.8
30	2.4	.....	.7	3.1	2.3	.8	1.6	3.2	1.5	1.3	2.6	1.8
31	2.4	.....	.7	.....	1.6	.....	1.5	3.3	.....	1.3	.....	1.8

Rating table for Pecos River near Pecos, Tex.

JANUARY 1, 1906, TO APRIL 25, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.70	70	1.30	210	1.90	385	2.50	600	3.10	855
0.80	90	1.40	235	2.00	420	2.60	640	3.20	900
0.90	110	1.50	260	2.10	455	2.70	680	3.30	950
1.00	135	1.60	290	2.20	490	2.80	720	3.40	1,000
1.10	160	1.70	320	2.30	525	2.90	765	3.50	1,050
1.20	185	1.80	350	2.40	560	3.00	810	3.60	1,100

[a] This table is based on five discharge measurements made during 1906 and is well defined below gage height 2.5 feet.

Rating table for Pecos River near Pecos, Tex.—Continued.

APRIL 26, 1906, TO DECEMBER 31, 1906.[a]

0.60	10	1.50	175	2.40	440	3.30	805	4.40	1,410
0.70	25	1.60	200	2.50	475	3.40	850	4.60	1,530
0.80	40	1.70	225	2.60	510	3.50	900	4.80	1,660
0.90	55	1.80	250	2.70	550	3.60	950	5.00	1,790
1.00	70	1.90	280	2.80	590	3.70	1,005	5.20	1,930
1.10	90	2.00	310	2.90	630	3.80	1,060	5.40	2,080
1.20	110	2.10	340	3.00	670	3.90	1,115	5.60	2,230
1.30	130	2.20	370	3.10	715	4.00	1,170	5.80	2,380
1.40	150	2.30	405	3.20	760	4.20	1,290		

[a] This table is based on ten discharge measurements made during 1906 and is well defined between gage heights 1.2 feet and 4.4 feet.

Monthly discharge of Pecos River near Pecos, Tex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	720	560	643	39,500
February	600	455	568	31,500
March	455	50	196	12,100
April	1,100	70	343	20,400
May	900	55	355	21,800
June	760	10	279	16,600
July	2,340	10	622	38,200
August	805	70	277	17,000
September	805	40	120	7,140
October	175	55	129	7,930
November	510	130	208	12,400
December	1,930	250	843	51,800
The year	2,340	10	382	276,000

NOTE.—Values are rated as follows: January and February, May to August, November and December, excellent; March, April, September, and October, good.

Discharge measurements of Margueretta Flume near Pecos, Tex., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
November 11	J. M. Giles	20.5	14	0.80	32
December 6	E. Patterson	20.5	13.3	.65	21
1906.					
January 1	J. M. Giles	20.5	10	.60	20
February 9	E. Patterson	20.5	14	.75	27
March 2	do	20.5	27	1.30	64
March 22	do	20.5	39	1.90	139
April 6	do	20.5	39	1.90	144
May 2	J. M. Giles	30.5	51	2.50	237
May 11	E. Patterson	20.5	41	2.00	141
June 7	J. M. Giles	20.5	45	2.20	152
June 8	do	20.5	45	2.20	150
June 13	E. Patterson	20.5	55	2.62	202
June 14	do	20.5	55	2.60	198
July 16	J. M. Giles	20.5	41	2.00	124

Daily gage height, in feet, of Margueretta flume near Pecos, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.6	0.7	1.3	1.8	2.4	2.0	2.5	2.4	2.5	1.9	1.7	0.6
2	.6	.7	1.3	1.9	2.4	2.0	2.5	2.4	2.4	1.9	1.7	.6
3	.6	.7	1.3	1.9	2.2	2.25	2.4	2.4	2.3	1.9	1.7	.6
4	.6	.7	1.3	1.9	2.2	1.9	2.4	2.4	2.2	1.9	1.7	.6
5	.6	.7	1.7	1.9	2.3	1.7	2.4	2.45	2.2	1.9	1.7	.6
6	.6	.7	1.7	1.9	2.4	2.0	2.4	2.5	2.2	1.9	1.7	.6
7	.6	.7	1.7	1.8	2.4	2.15	2.4	2.45	2.2	1.9	1.7	.6
8	.6	.7	1.7	1.9	2.4	2.4	2.4	2.6	2.0	1.9	1.7	.6
9	.6	.7	1.7	2.2	2.3	2.4	2.4	2.6	2.0	1.8	1.7	.6
10	.6	.7	1.7	1.9	2.3	2.4	1.8	2.4	2.0	1.8	1.7	.6

Daily gage height, in feet, of Margueretta flume near Pecos, Tex., 1906—Continued.

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	0.6	0.7	1.7	1.9	2.0	2.45	1.8	2.4	2.0	1.8	1.7	0.4
12	.6	.7	1.7	1.9	1.9	2.5	1.8	2.4	2.0	1.8	0.6	.4
13	.6	.7	1.7	1.9	1.9	2.5	1.8	2.4	2.0	1.8	.6	.4
14	.6	.7	1.7	1.9	1.9	2.45	2.0	2.4	2.0	1.8	.6	.4
15	.6	.7	1.7	1.9	1.9	2.4	2.0	2.5	2.0	1.8	.6	.4
16	.6	.7	1.7	1.9	1.9	2.4	1.9	2.5	1.9	1.8	.6	.4
17	.6	.7	1.7	2.0	1.9	2.2	1.9	2.5	1.9	1.8	.6	.4
18	.7	.7	1.8	2.0	1.9	2.2	1.95	2.5	1.9	1.8	.6	.4
19	.7	.7	1.8	2.0	2.0	1.95	1.9	2.5	1.9	1.8	.6	.4
20	.7	.7	1.8	2.0	2.1	1.85	1.95	2.6	1.9	1.8	.6	.4
21	.7	.7	1.9	2.0	2.1	1.9	2.0	2.6	1.9	1.5	.6	.4
22	.7	.7	1.9	2.2	2.3	2.0	2.0	2.4	1.9	1.5	.6	.4
23	.7	.7	1.8	2.4	2.3	2.0	2.3	2.4	1.9	1.5	.6	.4
24	.7	.7	1.8	2.4	2.3	2.0	2.2	2.4	2.0	1.5	.6	.4
25	.7	.7	1.8	2.4	2.4	2.0	2.2	2.4	2.0	1.5	.6	.4
26	.7	.7	1.8	2.4	2.4	2.2	2.2	2.4	2.0	1.8	.6	.4
27	.7	.7	1.8	2.4	2.5	2.2	1.7	2.4	2.0	1.8	.6	.4
28	.7	1.3	1.8	2.4	2.5	2.2	2.2	2.35	1.0	1.8	.6	.4
29	.7	.....	1.8	2.4	2.4	2.6	2.2	2.4	1.0	1.8	.6	.4
30	.7	.....	1.8	2.4	2.2	2.5	2.1	2.5	1.0	1.7	.6	.4
31	.7	.....	1.9	.....	2.2	.....	2.4	2.5	.....	1.7	.....	.4

NOTE.—These gage heights are equal to the depth of water in the flume near the lower end.

Rating table for Margueretta flume near Pecos, Tex.

NOVEMBER 17, 1905, TO MAY 24, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.60	20	1.00	41	1.40	75	1.80	126	2.20	188
0.70	25	1.10	48	1.50	87	1.90	141	2.30	204
0.80	30	1.20	56	1.60	99	2.00	156	2.40	220
0.90	35	1.30	65	1.70	112	2.10	172		

MAY 25, 1906, TO DECEMBER 31, 1906.[b]

0.40	12	0.90	35	1.40	70	1.90	115	2.40	173
0.50	16	1.00	41	1.50	78	2.00	125	2.50	186
0.60	20	1.10	48	1.60	87	2.10	136	2.60	200
0.70	25	1.20	55	1.70	96	2.20	148		
0.80	30	1.30	62	1.80	105	2.30	160		

[a] This table is based on eight discharge measurements made during 1905–6 and is well defined.
[b] This table is based on ten discharge measurements made during 1905–6 and is well defined between gage heights 0.6 foot and 2.5 feet. Between the measurements of May 2 and June 7, 1906, a change of conditions occurred. As nothing is known of the exact time, the change of rating tables is made halfway between these dates.

Monthly discharge of Margueretta flume near Pecos, Tex., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
November 17–30	30	30	30.0	833
December	30	20	23.1	1,420
The period	.....	.....	.....	2,250

Monthly discharge of Margueretta flume near Pecos, Tex., for 1905–6—Continued.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1906.				
January	25	20	22.3	1,370
February	65	25	26.4	1,470
March	141	65	114	7,010
April	220	126	167	9,940
May	220	141	178	10,900
June	200	96	148	8,810
July	186	96	142	8,730
August	200	166	180	11,100
September	186	41	122	7,260
October	115	78	103	6,330
November	96	20	47.9	2,850
December	20	12	14.6	898
The year	220	12	105	76,600

NOTE.—Values are rated as follows: November and December, 1905, January to March, May, and October to December, 1906, good; April and June to September, excellent.

PECOS RIVER NEAR MOORHEAD, TEX.

This station was established by the International (Water) Boundary Commission in April, 1900. It is near Moorhead, immediately above the high bridge of the Southern Pacific Railroad. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 110, where are given also references to publications that contain data for previous years.

Discharge measurements of Pecos River near Moorhead, Tex., in 1906, by E. E. Winter.

Date.	Area of section.	Gage height.	Discharge.	Date.	Area of section.	Gage height.	Discharge.
	Sq. ft.	*Feet.*	*Sec.-ft.*		*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 4	779	2.1	933	June 28	764	1.6	667
January 8	770	2.0	765	July 2	693	1.1	511
January 13	766	2.1	877	July 10	780	2.4	709
January 17	770	2.1	818	July 14	774	2.1	674
January 20	777	2.1	866	July 18	721	1.85	581
January 24	771	2.1	822	July 22	785	2.75	727
January 29	749	2.0	695	July 25	803	2.9	874
February 3	762	2.0	740	July 29	797	2.7	767
February 8	765	1.95	648	August 3	762	1.95	700
February 14	786	2.0	839	August 6	4,021	21.3	28,519
February 19	785	2.0	859	August 22	842	2.55	769
February 23	782	2.0	836	August 29	767	2.05	726
February 26	785	2.0	800	September 4	810	2.1	613
March 3	752	1.9	661	September 8	791	2.4	826
March 8	743	1.75	648	September 13	815	2.0	625
March 13	732	1.65	598	September 19	769	1.7	577
March 17	716	1.55	517	September 24	750	1.5	543
March 22	691	1.4	475	September 27	732	1.45	535
March 25	681	1.35	453	October 3	683	1.55	506
March 29	675	1.3	439	October 8	706	1.5	539
April 8	683	1.4	546	October 11	717	1.5	564
April 12	661	1.2	426	October 16	715	1.5	539
April 16	665	1.2	441	October 19	714	1.5	559
April 20	693	1.5	568	October 23	710	1.5	557
April 24	663	1.15	414	October 25	711	1.5	524
April 28	681	1.4	545	October 29	710	1.5	527
May 3	780	2.1	764	November 3	694	1.5	542
May 7	768	1.9	730	November 8	707	1.5	529
May 11	733	1.75	627	November 12	710	1.5	518
May 15	718	1.5	605	November 16	708	1.5	524
May 20	769	1.55	761	November 21	706	1.5	520
May 24	680	1.2	496	November 24	711	1.5	539
May 29	720	1.5	610	November 28	720	1.55	499
June 4	805	2.2	768	December 3	687	1.6	532
June 8	774	1.75	720	December 7	764	2.2	773
June 12	770	1.6	684	December 11	778	2.65	775
June 16	772	1.9	705	December 14	771	2.4	734
June 21	768	1.7	679	December 18	779	2.4	729
June 25	766	1.6	674	December 30	762	2.2	720

Daily gage height, in feet, of Pecos River near Moorhead, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.1	2.0	1.9	1.3	2.15	1.95	1.15	2.1	2.1	1.5	1.5	1.55
2	2.1	2.0	1.9	1.3	2.1	2.0	1.1	2.0	2.75	1.55	1.5	1.6
3	2.1	2.0	1.9	1.3	2.1	4.95	1.1	1.9	2.3	1.55	1.5	1.6
4	2.1	2.0	1.85	1.3	2.1	2.45	1.05	1.7	2.15	1.55	1.5	1.6
5	2.0	2.0	1.85	1.3	2.1	2.25	1.3	1.7	2.8	1.5	1.5	1.85
6	2.0	2.0	1.85	1.5	2.0	1.85	1.5	14.6	2.9	1.5	1.5	2.05
7	2.0	2.0	1.8	1.4	1.9	1.6	3.35	3.9	2.55	1.5	1.5	2.15
8	2.0	1.95	1.8	1.4	1.9	1.75	5.0	2.4	2.4	1.5	1.5	2.45
9	2.0	1.95	1.75	1.4	1.8	2.05	2.5	2.15	2.35	1.5	1.5	2.3
10	2.0	1.95	1.7	1.3	1.75	1.85	2.35	1.95	2.2	1.5	1.5	2.9
11	2.1	1.95	1.65	1.25	1.75	1.7	2.3	23.65	2.15	1.5	1.5	2.65
12	2.1	1.95	1.65	1.2	1.7	1.6	2.1	20.25	2.0	1.5	1.5	2.6
13	2.1	2.0	1.65	1.2	1.7	1.45	2.1	4.0	2.0	1.5	1.5	2.45
14	2.1	2.0	1.6	1.2	1.55	1.4	2.1	2.65	1.9	1.5	1.5	2.4
15	2.1	2.0	1.6	1.2	1.5	1.7	2.2	2.4	1.85	1.5	1.5	2.4
16	2.1	2.0	1.6	1.2	1.45	1.9	1.95	2.05	1.75	1.5	1.5	2.35
17	2.1	2.0	1.55	1.4	1.4	1.95	2.0	2.0	1.75	1.5	1.5	2.4
18	2.1	2.0	1.55	1.3	1.35	1.95	1.85	2.0	1.7	1.5	1.5	2.4
19	2.1	2.0	1.5	1.25	1.85	1.9	2.0	2.15	1.7	1.5	1.5	2.4
20	2.1	2.0	1.5	1.4	1.65	1.8	2.45	2.5	1.65	1.5	1.5	2.4
21	2.1	2.0	1.45	1.2	1.4	1.75	2.6	2.6	1.6	1.5	1.5	2.35
22	2.1	2.0	1.4	1.2	1.4	1.6	2.75	2.55	1.6	1.5	1.5	2.3
23	2.1	2.0	1.4	1.15	1.4	1.6	3.0	2.5	1.6	1.5	1.5	2.3
24	2.1	2.0	1.4	1.15	1.25	1.55	2.9	2.4	1.5	1.5	1.5	2.3
25	2.1	2.0	1.35	1.15	1.3	1.6	2.9	2.35	1.55	1.5	1.55	2.3
26	2.1	2.0	1.35	1.2	1.45	1.4	2.9	2.2	1.5	1.5	1.55	2.3
27	2.1	2.0	1.35	1.3	1.5	1.45	2.85	8.25	1.45	1.5	1.55	2.3
28	2.1	2.0	1.3	1.4	1.4	1.55	2.7	2.5	1.55	1.5	1.55	2.2
29	2.0	.....	1.3	1.8	1.45	1.4	2.85	2.05	1.5	1.5	1.55	2.2
30	2.0	.....	1.3	2.05	1.55	1.2	2.4	2.1	1.5	1.5	1.55	2.2
31	2.0	.....	1.3	.....	1.7	.....	2.25	2.05	.....	1.5	.....	2.2

Daily discharge, in second-feet, of Pecos River near Moorhead, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1,000	710	700	440	925	790	525	670	730	530	530	500
2	980	725	680	450	835	810	[a] 510	680	800	525	535	550
3	955	[a] 740	[a] 660	460	[a] 765	4,340	510	[a] 690	670	[a] 505	[a] 540	[a] 530
4	[a] 935	730	640	470	765	[a] 1,090	500	650	[a] 625	515	540	550
5	840	720	660	480	765	850	540	650	825	510	540	630
6	815	710	680	600	745	675	580	[a] 18,470	855	520	535	710
7	790	700	660	540	[a] 730	570	2,060	1,840	835	530	530	[a] 750
8	[a] 765	[a] 650	[a] 680	[a] 545	720	[a] 720	4,400	790	[a] 825	[a] 540	[a] 530	810
9	775	670	650	545	670	840	730	740	800	550	530	790
10	785	690	625	485	640	770	[a] 705	700	725	560	525	880
11	855	715	600	455	[a] 630	720	700	35,570	700	[a] 565	525	[a] 775
12	865	740	600	[a] 425	630	[a] 685	675	26,940	625	560	[a] 520	765
13	[a] 875	815	[a] 600	430	650	655	675	1,910	[a] 625	555	520	740
14	860	[a] 840	570	430	610	645	[a] 675	865	610	550	520	[a] 735
15	845	845	560	435	[a] 605	680	695	790	600	545	520	725
16	830	850	550	[a] 440	610	[a] 705	610	710	585	[a] 540	[a] 525	720
17	[a] 820	850	520	525	615	715	630	700	585	545	525	730
18	835	855	520	485	625	715	[a] 580	700	575	555	525	[a] 730
19	850	[a] 860	505	465	850	705	605	720	[a] 575	[a] 560	520	735
20	[a] 865	850	505	[a] 530	[a] 800	690	675	765	565	560	520	740
21	850	845	490	435	670	[a] 685	700	780	560	560	[a] 520	730
22	840	840	[a] 475	435	640	675	[a] 725	[a] 770	560	555	525	720
23	830	[a] 835	475	415	610	675	855	765	560	[a] 555	530	720
24	[a] 820	825	475	[a] 415	[a] 515	670	845	755	[a] 545	540	[a] 540	725
25	810	810	[a] 455	415	530	[a] 675	[a] 875	750	550	[a] 525	545	725
26	795	[a] 800	455	440	590	655	875	735	545	525	530	730
27	785	800	455	490	610	660	850	8,870	[a] 535	525	515	730
28	770	800	440	[a] 545	570	[a] 665	770	765	555	525	[a] 500	710
29	[a] 695	.....	[a] 440	785	[a] 590	605	[a] 850	[a] 725	545	[a] 525	500	715
30	695	.....	440	935	630	545	705	730	545	525	500	[a] 720
31	695	.....	440	.....	690	.....	675	725	.....	530	.....	720

[a] Dates of measurements.

Monthly discharge of Pecos River near Moorhead, Tex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	1,000	695	830	51,025
February	860	650	779	43,279
March	700	440	555	34,126
April	935	415	498	29,643
May	925	515	672	41,316
June	4,340	545	829	49,349
July	4,400	500	849	52,175
August	35,570	650	3,610	221,990
September	855	535	641	38,152
October	560	510	539	33,144
November	545	500	525	31,259
December	880	500	710	43,636
The year	35,570	415	920	669,094

GALLINAS RIVER NEAR LAS VEGAS, N. MEX.

This station was established August 13, 1903, at Las Vegas Hot Springs, 6 miles above Las Vegas, N. Mex. The establishment of this station was primarily for the purpose of determining the amount of water available for diversion and storage in the San Guyjuella basin about 6 miles northwest of Las Vegas. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 115, where are given also references to publications that contain data for previous years.

Discharge measurements of Gallinas River near Las Vegas, N. Mex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 14	J. M. Giles	20	17	2.00	22
April 15	E. Patterson	26	35	2.30	66
April 18	do	26	39	2.45	98
April 26[a]	J. M. Giles	32	45	2.57	138
April 28	do	28	40	2.50	116
May 24	E. Patterson	26	35	2.40	76
May 27	do	25	31	2.28	55
July 18[b]	J. M. Giles	28	40	2.15	42
July 20[b]	do	28	41	2.15	41
August 15[b]	do	18	15	1.95	17

[a] Measurement made from bridge. [b] Measurement made from trestle.

Daily gage height, in feet, of Gallinas River near Las Vegas, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.9	1.85	1.9	2.2	2.5	2.3	1.8	2.0	1.9	2.0	2.0	2.0
2	1.9	1.8	1.9	2.2	2.5	2.3	1.85	2.0	1.9	2.0	2.0	2.05
3	1.9	1.8	1.9	2.2	2.5	2.3	1.9	2.0	1.9	2.0	2.0	2.2
4	1.9	1.8	1.9	2.2	2.5	2.3	1.95	2.0	1.9	1.95	2.0	2.9
5	1.9	1.8	1.9	2.2	2.5	2.2	2.0	2.0	1.9	2.05	1.95	2.7
6	1.9	1.8	2.1	2.2	2.6	2.2	2.25	2.1	1.9	2.1	1.95	2.5
7	1.85	1.8	1.9	2.45	2.55	2.2	2.05	2.1	1.9	2.1	2.0	2.45
8	1.8	1.8	2.05	2.35	2.5	2.2	2.4	2.15	1.9	1.95	1.95	2.3
9	1.8	1.8	1.9	2.3	2.55	2.2	2.25	2.35	1.9	1.9	1.9	2.3
10	1.8	1.8	1.9	2.4	2.55	2.1	2.15	2.15	1.9	1.85	1.9	2.2
11	1.8	1.8	1.95	2.4	2.5	2.1	2.25	2.05	1.9	1.9	1.9	2.2
12	1.8	1.8	2.0	2.4	2.6	2.1	2.2	2.0	1.85	1.95	1.9	2.2
13	1.8	1.8	2.0	2.35	2.6	2.3	2.2	2.0	1.8	1.95	1.9	2.2
14	1.8	1.8	2.0	2.3	2.6	2.2	2.2	2.0	1.8	2.0	1.9	2.1
15	1.8	1.8	2.0	2.3	2.5	2.15	2.2	2.0	1.85	2.0	1.9	2.1

Daily gage height, in feet, of Gallinas River near Las Vegas, N. Mex., for 1906—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	1.8	1.8	2.1	2.4	2.5	2.05	2.45	2.0	1.8	2.0	1.9	1.95
17	1.8	1.8	2.0	2.5	2.45	1.95	2.55	1.9	1.8	1.85	1.9	1.9
18	1.8	1.8	2.0	2.5	2.4	1.9	2.2	1.9	1.8	1.8	1.9	1.95
19	1.8	1.8	1.95	2.8	2.45	1.9	2.1	1.9	1.8	1.75	1.9	2.0
20	1.85	1.8	1.9	2.7	2.5	1.9	2.3	1.9	1.8	1.65	1.9	2.0
21	1.8	2.1	2.0	2.65	2.5	1.9	2.1	1.9	1.8	1.6	1.9	2.0
22	1.8	1.9	2.0	2.6	2.5	1.9	2.0	1.9	1.8	1.75	1.9	2.0
23	1.8	2.05	2.0	2.6	2.5	1.9	2.0	1.9	1.8	1.8	1.9	2.0
24	1.8	1.95	2.0	2.6	2.4	1.9	2.0	1.9	1.8	1.8	1.9	2.0
25	1.8	1.9	2.1	2.6	2.4	1.9	2.0	1.9	1.8	1.7	1.9	2.0
26	1.8	1.9	2.2	2.6	2.4	1.9	2.0	1.9	1.85	1.75	1.9	2.0
27	1.8	1.9	2.2	2.6	2.3	1.9	2.0	1.9	2.3	1.95	1.9	2.0
28	1.8	1.9	2.2	2.6	2.3	1.85	2.0	1.9	2.15	2.0	1.9	2.0
29	1.8	.....	2.4	2.6	2.3	1.8	2.0	1.9	2.1	2.0	1.9	2.0
30	1.7	.....	2.2	2.5	2.3	1.8	2.0	1.9	2.0	2.1	1.9	2.0
31	1.75	.....	2.0	.....	2.3	.....	2.0	1.9	.....	2.1	.....	1.9

Rating table for Gallinas River near Las Vegas, N. Mex., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.60	2	1.90	14	2.20	47	2.50	107	2.80	200
1.70	4	2.00	22	2.30	64	2.60	134	2.90	240
1.80	8	2.10	33	2.40	84	2.70	165		

NOTE.—The above table is based on ten discharge measurements made during 1906 and is well defined between gage heights 1.9 feet and 2.6 feet.

Monthly discharge of Gallinas River near Las Vegas, N. Mex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	14	4	9.2	566
February	33	8	11.1	616
March	84	14	25.9	1,590
April	200	47	98.7	5,870
May	134	64	101.0	6,210
June	64	8	31.8	1,890
July	120	8	38.5	2,370
August	74	14	21.9	1,350
September	64	8	14.7	875
October	33	2	17.0	1,050
November	22	14	15.7	934
December	240	14	45.6	2,800
The year	240	2	35.9	26,100

NOTE.—Values are rated as follows: January, February, and September to November, fair; remainder of year, good.

HONDO RIVER AT ROSWELL, N. MEX.

This station was established April 25, 1903, and was discontinued March 2, 1906. It is located at the bridge at the intersection of Main and Vegas streets, Roswell, N. Mex. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 117, where are given also references to publications that contain data for previous years.

Discharge measurements of Hondo River at Roswell, N. Mex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 15	E. Patterson	18	5.6	1.70	6
February 3	do	18	10.0	2.10	18
February 12	do	16	5.2	1.95	4.9
February 19	do	4	.8	1.45	.33
April 6[a]	E. C. Murphy			1.52	.6

[a] Estimated.

Daily gage height, in feet, of Hondo River at Roswell, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	2.5	2.2	1.4	12	2.45	1.75		23	2.5	1.4	
2	2.5	2.2	1.4	13	2.35	1.9		24	2.55	1.4	
3	2.4	2.2		14	2.25	1.65		25	2.6	1.4	
4	2.3	2.2		15	2.1	1.65		26	2.55	1.4	
5	2.15	2.25		16	2.0	1.6		27	2.55	1.4	
6	2.0	2.0		17	2.3	1.5		28	2.55	1.4	
7	2.3	2.0		18	2.05	1.55		29	2.5		
8	2.45	1.5		19	1.8	1.5		30	2.5		
9	2.2	1.5		20	2.2	1.45		31	2.35		
10	2.35	1.5		21	2.45	1.4					
11	2.3	1.5		22	2.6	1.4					

NOTE.—The gage was lowered 3.00 feet February 8, 1906; all gage heights for 1906 refer to the new datum.

Daily discharge, in second-feet, of Hondo River at Roswell, N. Mex., for 1906.

Day.	Jan.	Feb.	Day.	Jan.	Feb.	Day.	Jan.	Feb.
1	33	21	12	31	2.5	23	33	.2
2	33	21	13	27	4.5	24	36	.2
3	29	21	14	23	1.6	25	38	.2
4	25	21	15	18	1.6	26	36	.2
5	20	23	16	15	1.2	27	36	.2
6	15	12	17	25	0.6	28	36	.2
7	25	12	18	16	.9	29	33	
8	31	2	19	8	.6	30	33	
9	21	2	20	21	.4	31	27	
10	27	2	21	31	.2			
11	25	1	22	38	.2			

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Hondo River at Roswell, N. Mex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	38	8	27.3	1,680
February	23	0.2	5.5	305
The period				1,980

NOTE.—Values rated as approximate.

HONDO RIVER AT HONDO RESERVIOR SITE, NEW MEXICO.

This station was established March 9, 1903, at the first New Mexico reservoir dam site, 12 miles southwest of Roswell, N. Mex. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 118, where are given also references to publications that contain data for previous years.

Discharge measurements of Hondo River at Hondo reservoir site, New Mexico, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 13	E. Patterson	20	11	3.00	32
January 31	do	23	11	3.05	31
February 9	J. M. Giles	16	10	3.00	28
February 13	E. Patterson	18	12	3.06	30
February 24[a]	do	13	68	2.70	9.6
April 6	E. C. Murphy	12	11	2.98	18
April 8	E. Patterson	17	9	3.05	23
April 24	J. M. Giles	16	13	2.80	28
April 28	do	16	11	2.65	20
August 6[b]	do	14.7	5.4	2.30	5.3
December 20	William A. Lamb	11.5	4.8	2.10	4.9

[a] Part of flow of river diverted into Inlet Canal about 2 miles above the station.
[b] Measured at Scour Gate No. 1.

Daily gage height, in feet, of Hondo River at Hondo reservoir site, New Mexico, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.4	3.0	2.6	2.4					2.55	3.0	2.3	2.3
2	4.8	3.1	2.6	2.35				2.35	2.6	2.9	2.3	2.2
3	4.75	3.0	2.6	2.65				2.05	2.55	2.7	2.4	2.4
4	4.6	3.0	2.6	2.95	2.1			2.15	2.5	2.7	2.4	2.3
5	4.3	3.0	2.65	2.9				2.55	2.5	2.7	2.3	2.2
6	4.7	3.0	2.65	3.0				2.3	2.3	2.75	2.25	2.2
7	4.0	3.0	2.6	3.05					2.2	2.55	2.2	2.35
8	2.75	3.05	2.6	3.1					2.2	2.15	2.2	2.5
9	2.9	3.0	2.6	3.4					2.15	2.1	2.2	2.5
10	2.9	2.95	2.4	3.3					2.1	2.1	2.2	2.25
11	3.05	3.0		3.05					2.1	2.1	2.2	2.4
12	3.0	3.05		2.95					2.05	2.1	2.2	2.4
13	3.05	3.1		2.95						2.1	2.2	2.3
14	3.1	3.05		3.0						2.0	2.2	
15	3.05	2.9		3.0						2.0	2.2	
16	3.05	2.9	2.45	3.05						2.1	2.2	2.15
17	3.1	2.9	2.45	3.15						2.1	2.2	2.2
18	3.2	2.9	2.45	3.05						2.1	2.2	2.15
19	3.15	2.9	2.45	2.9						2.1	2.2	
20	3.2	2.85	2.75	3.0						2.1	2.2	2.1
21	3.25	2.7	2.4	3.0						2.1	2.8	2.1
22	3.3	2.7	2.3	2.95						2.1	2.8	2.1
23	3.25	2.7	2.3	2.9			2.2			2.0	3.0	2.1
24	3.25	2.7	2.15	2.85			2.3			2.0	3.1	2.1
25	3.3	2.7		2.75			2.1			2.0	3.25	2.1
26	3.15	2.7	2.2	2.75						1.95	2.9	2.1
27	3.15	2.6	2.3	2.7					2.2	1.9	2.4	2.1
28	3.15	2.6	2.35	2.6					2.3	1.9	2.2	2.1
29	3.15		2.35	2.55					2.7	1.95		2.1
30	3.15		2.4	2.35				3.05	3.1	2.15	2.4	2.1
31	3.05		2.35					2.6		2.3		2.1

NOTE.—The river was dry on days when the gage was not read, except from August 7 to 29. The discharge during that period was measured at Scour Gate No. 1.

Daily discharge, in second-feet, of Hondo River at Hondo reservoir site, New Mexico, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	158	28	7	2	0	0	0	0	13	39	8	9
2	200	34	7	1	0	0	0	6	15	32	8	6
3	195	28	7	7	0	0	0	1	13	21	11	13
4	180	28	7	17	3	0	0	2	11	21	11	9
5	148	28	8	15	0	0	0	13	11	21	8	6
6	190	28	8	19	0	0	0	5	5	24	6	7
7	118	28	6	22	0	0	0	.....	3	15	5	12
8	19	31	6	25	0	0	0	.....	3	3	5	18
9	26	28	6	44	0	0	0	.....	2	2	5	18
10	26	25	2	37	0	0	0	.....	2	2	5	9
11	35	28	0	27	0	0	0	.....	2	2	5	14
12	32	30	0	22	0	0	0	.....	1	2	5	14
13	35	32	0	22	0	0	0	.....	0	2	6	10
14	38	30	0	24	0	0	0	.....	0	1	6	0
15	35	22	0	29	0	0	0	.....	0	1	6	0
16	35	21	3	32	0	0	0	.....	0	2	6	6
17	38	21	3	38	0	0	0	.....	0	2	6	7
18	44	20	3	32	0	0	0	.....	0	2	6	6
19	41	20	3	30	0	0	0	.....	0	2	6	0
20	44	18	10	36	0	0	0	.....	0	3	6	5
21	48	11	2	35	0	0	0	.....	0	3	32	5
22	52	11	1	33	0	0	0	.....	0	3	32	5
23	44	11	1	34	0	0	3	.....	0	2	46	5
24	44	10	0	31	0	0	5	.....	0	2	54	5
25	48	10	0	26	0	0	2	.....	0	2	66	5
26	37	10	0	25	0	0	0	.....	0	1	39	5
27	37	7	1	23	0	0	0	.....	4	1	13	5
28	37	7	1	18	0	0	0	.....	6	1	6	5
29	37	.....	1	16	0	0	0	.....	21	1	0	5
30	37	.....	2	8	0	0	0	39	45	4	13	5
31	31	.....	1	.....	0	.....	0	15	.....	8	.....	5

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Hondo River at Hondo reservoir site, New Mexico, for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	200	19	67.4	4,140
February	34	7	21.6	1,200
March	10	0	3.10	191
April	44	1	24.4	1,450
May	3	0	0.10	6.1
June	0	0	0	0
July	5	0	0.32	19.7
August, 8 days	39	0	10.1	160
September	45	0	5.23	311
October	39	1	7.32	450
November	66	0	14.4	857
December	18	0	7.23	445
The period				9,230

NOTE.—Values are rated as approximate.

INLET CANAL AT HONDO RESERVOIR, NEAR ROSWELL, N. MEX.

This station was established August 7, 1906, for the purpose of determining the amount of water diverted into the Hondo reservoir. It is located 12 miles southwest of Roswell, just below the sand check at the lower end of the Inlet Canal.

The station is located on a curve of the channel. The bed is somewhat shifting on account of the channel being excavated

through a more or less shifting material. Both banks are high and not liable to overflow.

At low water discharge measurements are made by wading 50 feet below the gage. High-water measurements are to be made from a cable and car, which will be erected during the present season.

The gage established August 7 consists of notches cut in the vertical face of the right-hand wing wall of the sand-check gate. The graduations range from 2 to 5.5 feet. On August 25 a gage was established by the reclamation engineers. It consists of a timber graduated from 0 to 2.3 feet, fastened to the east face of the first partition from the east end of the sand-check gate. The zero rests on the sill of the gate. A separate rating curve should be used from August 25 to December 31. Observations at this station are made by John F. Boscoe, gate keeper at the Hondo reservoir.

Discharge measurements of Inlet Canal at Hondo reservoir, near Roswell, N. Mex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 6	J. M. Giles	48	34	2.02	40
August 7	do	55	51	2.33	93
December 20	William A. Lamb	35	22	[a] 0.22	32

[a] Second gage.

Daily gage height, in feet, of Inlet Canal at Hondo Reservoir, near Roswell, N. Mex., for 1906.

Day.	Aug.	Sept.	Oct.	Nov.	Dec.	Day.	Aug.	Sept.	Oct.	Nov.	Dec.
1		0.1			0.2	17			0.1		0.3
2		.1			.3	18			.1		.3
3		.1			.4	19			.1		.25
4		.1		0.05	.45	20			.1		.2
5		.1		.05	.75	21			.1		.25
6		.1		.05	.95	22			.1	0.1	.2
7	2.25	.05	0.05		.65	23			.1	.15	.2
8	1.95	.05	.1		.5	24			.1	.1	.2
9	2.25	.04	.1		.4	25	0.1		.1	.15	.2
10	1.9	.02	.1		.4	26	.6		.1	.2	.2
11	1.25	.04	.1		.35	27	.6	0.3	.1	.2	.2
12	0.3		.1		.35	28	.25	.35	.1	.1	.15
13			.1		.3	29	.1	.15	.1	.2	.15
14		.04	.1		.3	30	.05		.08	.15	.22
15		.02	.15		.25	31	.1		.02		.25
16			.1		.3						

NOTE.—The canal was dry on days when the gage was not read.

SCOUR GATE NO. 1, HONDO RESERVOIR, NEAR ROSWELL, N. MEX.

This station was established for the purpose of determining the amount of water flowing down Hondo River past the reservoir. It is located just below the opening of the scour gate.

Discharge measurements are made by wading at convenient points below the gate. The channel is straight below the gate and is in fair condition for measurements.

The gage consists of graduations from 0.5 to 2.5 feet, painted on the concrete wing wall at the east side of the gate opening. Observations at this station are made by John F. Boscoe, gate keeper at the Hondo Reservoir.

Discharge measurements of Scour Gate No. 1, Hondo Reservoir, near Roswell, N. Mex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
August 6	J. M. Giles	14	5.4	.50	5.3
August 7	do	15.5	8.6	.70	15
August 7	do	16	11	.85	23

Daily gage height and discharge of Scour Gate No. 1, Hondo Reservoir, near Roswell, N. Mex., for 1906.

Day.	August.		September.		Day.	August.		September.	
	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*		*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1			0.3	1.6	19		0		0
2			.35	2.2	20		0		0
3			.3	1.6	21		0		0
4			.2	.8	22		0		0
5			.2	.8	23		0		0
6			.2	.8	24		0		0
7	0.6	9.5	.1	.2	25		0		0
8	.6	9.5	.1	.2	26		0		0
9	.6	9.5	.1	.2	27		0		0
10	.5	5.3	.05	.1	28		0		0
11		0	.1	.2	29		0	1.3	55
12		0		0	30	0.25	1.2		0
13		0		0	31	.5	5.3		
14		0		0					
15		0		0	Mean		1.6		2.1
16		0		0	Run-off in acre-feet, (7–31)		80		125
17		0		0					
18		0		0					

NOTE.—The scour gate was dry after September 30.

PENASCO RIVER NEAR DAYTON, N. MEX.

This station was established September 12, 1905, about 2 miles east and 1 mile north of Dayton and about 1 mile above the mouth of the river. The conditions at the station and the bench marks are described in Water-Supply Paper No. 174, page 121.

Discharge measurements of Penasco River near Dayton, N. Mex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 11	E. Patterson	24	15	1.30	32
January 16	do	25	19	1.38	49
February 1	do	20	21	1.38	48
February 13	J. M. Giles	28	24	1.40	53
March 24	E. Patterson	20	11	1.06	10
March 29	J. M. Giles	16	8.4	1.00	8.6
April 20	do	24	19	1.30	38
May 10	do	1.5	.3	.80	0.4
October 30	William A. Lamb	9	2	1.05	2

Daily gage height, in feet, of Penasco River near Dayton, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.4	1.4	1.0	1.1	0.3	.....	0.7	0.8	0.8	1.1	1.7
2	.....	1.4	1.3	1.0	1.1	.3	.....	.7	.9	.8	1.1	1.0
3	.....	1.4	1.3	1.0	1.1	.3	.....	.8	1.0	.8	1.1	1.3
4	.....	1.4	1.3	1.2	1.1	.1	.....	.7	.8	.9	1.1	1.3
5	.....	1.4	1.3	1.3	1.0	.....	.....	.9	.7	1.0	1.1	1.3
6	.....	1.4	1.3	1.3	.9	.....	0.7	.8	.6	1.0	1.1	1.3
7	.....	1.4	1.2	1.3	.8	.....	.8	.7	.7	1.0	1.1	1.3
8	.....	1.4	1.2	1.3	.7	.....	.7	.7	.9	1.0	1.1	1.3
9	.....	1.4	1.2	1.2	.7	.....	.7	.7	.9	1.0	1.1	1.3
10	.....	1.4	1.2	1.2	.8	.....	.7	.7	.8	1.0	1.1	1.3
11	.....	1.4	1.2	1.2	.8	.....	.7	.7	.8	1.0	1.1	1.3
12	.....	1.5	1.1	1.2	.8	.....	.6	.8	.7	1.0	1.1	1.3
13	.....	1.4	1.1	1.2	.7	.....	.5	.7	.7	1.0	1.1	1.3
14	.....	1.4	1.1	1.2	.8	.....	.7	.7	.8	1.0	1.1	1.3
15	.....	1.4	1.1	1.2	.8	.....	.7	.7	.8	1.2	1.1	1.3
16	.....	1.4	1.1	1.3	.9	.....	.7	.7	.7	1.1	1.1	1.3
17	.....	1.4	1.1	1.4	.8	.....	.8	.7	.8	1.0	1.1	1.3
18	.....	1.4	1.1	1.4	.7	.....	.9	.7	.8	1.0	1.1	1.3
19	.....	1.4	1.1	1.3	.7	.....	.8	.7	.8	1.0	.....	1.3
20	.....	1.4	1.1	1.3	.7	.....	.7	.7	.8	1.0	1.7	1.3
21	.....	1.4	1.2	1.3	.7	.....	.7	.7	.8	0.9	1.7	1.3
22	1.4	1.3	1.2	1.3	.7	.....	.7	.7	.8	.8	1.5	1.3
23	1.3	1.4	1.2	1.3	.7	.....	.7	.7	.8	.9	1.5	1.3
24	1.2	1.4	1.2	1.3	.7	.....	.7	.7	.8	1.0	1.5	1.4
25	1.3	1.4	1.1	1.3	.7	.....	.7	.7	.8	1.0	1.4	1.4
26	1.4	1.4	1.1	1.2	.6	.....	.7	.7	1.9	1.0	1.3	1.4
27	1.4	1.4	1.1	1.2	.6	.....	.7	2.3	1.2	1.0	1.2	1.3
28	1.4	1.4	1.1	1.3	.5	.....	.7	1.3	2.8	1.0	1.2	1.3
29	1.4	.....	1.0	1.2	.3	.....	.7	.7	.8	1.0	1.2	1.3
30	1.4	.....	1.0	1.1	.3	.....	.7	1.0	.8	1.0	1.2	1.3
31	1.4	.....	1.0	.....	.3	.....	.7	.9	.....	1.1	.....	1.3

NOTE.—The river was dry from June 5 to July 5, inclusive.

Rating table for Penasco River near Dayton, N. Mex., from January 1, 1906, to June 30, 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.70	0	0.90	3	1.10	13	1.30	35	1.50	73
0.80	0.4	1.00	7	1.20	23	1.40	53		

NOTE.—The above table is based on eight discharge measurements made during 1906 and is fairly well defined.

Monthly discharge of Penasco River near Dayton, N. Mex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January 22–31	53	23	46.4	920
February	73	35	53.1	2,950
March	53	7	20.2	1,240
April	53	7	28.3	1,680
May	13	0	2.2	135
June	0	0	0	0
The period	.....	.....	.....	6,920

NOTE.—Discharges have not been computed after June 30, on account of the lack of measurements. Values are rated as follows: January to April, good; May, approximate.

DEVILS RIVER DRAINAGE BASIN.

DEVILS RIVER AT DEVILS RIVER, TEX.

This station was established in April, 1900, by the International (Water) Boundary Commission. It is opposite the Southern Pacific Railroad station at Devils River.

The river is about 50 miles in length, has a perennial flow, and during flood periods is subject to great fluctuations. No good location for gaging station exists on this stream where it would be accessible from the railroad station. The conditions at the site chosen and the bench marks are described in Water-Supply Paper No. 174, page 123, where are given also references to publications that contain data for previous years.

Discharge measurements of Devils River near Devils River, Tex., in 1906, by E. E. Winter.

Date.	Area of section.	Gage height.	Discharge.	Date.	Area of section.	Gage height.	Discharge.
	Sq.-ft.	*Feet.*	*Sec.-ft.*		*Sq.-ft.*	*Feet.*	*Sec.-ft.*
January 2	372	2.4	502	June 23	360	2.25	418
January 10	372	2.4	445	June 29	357	2.25	412
January 18	372	2.4	447	July 7	474	2.7	920
January 26	356	2.4	451	July 12	794	3.7	1,939
January 30	362	2.4	444	July 20	545	2.9	1,026
February 6	357	2.4	426	July 26	463	2.8	731
February 10	361	2.4	417	July 30	467	2.8	771
February 16	357	2.4	415	August 4	491	2.8	806
February 20	364	2.4	425	August 9	642	3.25	1,525
February 24	359	2.4	417	September 2	566	2.95	915
February 27	364	2.4	422	September 5	572	2.95	934
March 5	364	2.4	425	September 14	558	2.9	891
March 14	357	2.35	365	September 21	549	2.85	872
March 19	356	2.35	393	September 29	546	2.85	849
March 26	358	2.35	397	October 4	535	2.8	831
March 30	358	2.35	393	October 12	533	2.8	811
April 10	355	2.35	417	October 20	527	2.8	754
April 13	392	2.45	536	October 30	506	2.7	719
April 21	352	2.25	400	November 5	492	2.65	715
April 26	352	2.25	398	November 13	507	2.7	727
April 29	353	2.3	401	November 22	507	2.7	699
May 4	364	2.3	411	November 30	505	2.7	698
May 9	357	2.25	391	December 8	497	2.7	711
May 16	359	2.25	393	December 15	494	2.7	688
May 21	362	2.25	404	December 19	499	2.7	679
June 5	987	4.3	2,600	December 31	486	2.65	687
June 13	385	2.4	577				

Daily gage height, in feet, of Devils River at Devils River, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.4	2.4	2.4	2.3	2.3	2.25	2.25	3.0	2.9	2.8	2.7	2.7
2	2.4	2.4	2.4	2.3	2.3	2.25	2.25	3.05	2.95	2.8	2.7	2.7
3	2.4	2.4	2.4	2.3	2.3	3.8	2.4	2.85	3.0	2.8	2.7	2.7
4	2.4	2.4	2.4	2.3	2.3	4.9	2.5	2.8	3.2	2.8	2.7	2.7
5	2.4	2.4	2.4	2.3	2.3	4.7	2.4	2.8	3.0	2.8	2.65	2.7
6	2.4	2.4	2.4	2.3	2.3	3.4	2.45	2.8	2.95	2.8	2.65	2.7
7	2.4	2.4	2.35	2.3	2.3	2.7	2.7	2.9	2.9	2.8	2.65	2.7
8	2.4	2.4	2.35	2.3	2.25	2.6	4.8	3.65	2.9	2.8	2.65	2.7
9	2.4	2.4	2.35	2.3	2.25	2.4	6.1	3.35	2.9	2.8	2.65	2.7
10	2.4	2.4	2.35	2.35	2.25	2.4	5.5	3.0	2.9	2.8	2.65	2.7
11	2.4	2.4	2.35	2.35	2.25	2.4	4.25	4.8	2.9	2.8	2.7	2.7
12	2.4	2.4	2.35	2.45	2.25	2.4	3.85	14.3	2.9	2.8	2.7	2.7
13	2.4	2.4	2.35	2.45	2.25	2.35	3.25	9.25	2.9	2.8	2.7	2.7
14	2.4	2.4	2.35	2.45	2.25	2.3	3.0	6.05	2.9	2.95	2.7	2.7
15	2.4	2.4	2.35	2.25	2.25	2.3	2.9	3.9	2.9	2.9	2.7	2.7
16	2.4	2.4	2.35	2.25	2.25	2.3	2.85	3.55	2.85	2.85	2.7	2.7
17	2.4	2.4	2.35	2.25	2.25	2.3	3.1	3.4	2.85	2.8	2.7	2.7
18	2.4	2.4	2.35	2.25	2.25	2.35	2.95	3.35	3.0	2.8	2.7	2.7
19	2.4	2.4	2.35	2.25	2.35	2.35	2.95	3.2	3.6	2.8	2.7	2.7
20	2.4	2.4	2.35	2.25	2.3	2.3	2.9	3.2	2.95	2.8	2.7	2.7
21	2.4	2.4	2.35	2.25	2.25	2.3	2.8	3.2	2.85	2.8	2.7	2.7
22	2.4	2.4	2.35	2.25	2.25	2.3	2.8	3.15	2.85	2.8	2.7	2.7
23	2.4	2.4	2.35	2.25	2.25	2.25	2.8	3.1	2.85	2.8	2.7	2.7
24	2.4	2.4	2.35	2.25	2.25	2.25	2.8	3.0	2.85	2.8	2.7	2.7
25	2.4	2.4	2.35	2.25	2.25	2.3	2.8	3.0	2.85	2.8	2.7	2.7
26	2.4	2.4	2.35	2.25	2.25	2.3	2.8	3.0	2.85	2.75	2.7	2.7
27	2.4	2.4	2.35	2.25	2.25	2.3	2.8	3.0	2.85	2.7	2.7	2.7
28	2.4	2.4	2.35	2.25	2.25	2.25	2.75	3.0	2.85	2.7	2.7	2.7
29	2.4	.....	2.35	2.3	2.25	2.25	2.75	3.0	2.85	2.7	2.7	2.7
30	2.4	.....	2.35	2.3	2.25	2.25	2.8	3.0	2.8	2.7	2.7	2.65
31	2.4	.....	2.35	.....	2.25	.....	2.75	2.95	.....	2.7	.....	2.65

Daily discharge in second-feet of Devils River at Devils River, Tex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	505	440	425	350	400	400	410	1,030	865	815	725	700
2	[a] 500	435	425	350	405	400	410	1,100	[a] 915	820	725	700
3	490	435	425	355	410	2,070	580	870	970	825	730	700
4	485	430	425	355	[a] 410	3,260	690	[a] 805	1,175	[a] 830	730	705
5	480	430	[a] 425	360	410	[a] 3,040	580	805	[a] 980	830	[a] 715	705
6	470	[a] 425	425	360	410	1,650	640	805	935	825	715	705
7	465	425	390	365	410	900	[a] 920	960	890	825	715	710
8	460	420	390	365	390	800	3,080	2,160	890	820	715	[a] 710
9	450	420	385	370	[a] 390	585	6,770	[a] 1,680	890	820	715	710
10	[a] 445	[a] 415	385	[a] 415	390	580	4,970	1,120	890	815	715	705
11	445	415	380	425	390	580	2,510	3,050	890	815	725	700
12	445	415	375	525	390	[a] 575	[a] 2,100	30,000	890	[a] 810	725	695
13	445	415	370	[a] 535	390	520	1,430	14,850	890	810	[a] 725	690
14	445	415	[a] 365	535	390	470	1,140	5,580	[a] 890	960	725	690
15	445	415	375	400	395	470	1,030	2,140	890	900	725	[a] 690
16	445	415	380	400	[a] 395	470	970	1,650	850	840	720	685
17	445	415	385	400	395	470	1,250	1,450	850	780	715	685
18	[a] 445	420	390	400	400	520	1,080	1,390	1,000	770	710	680
19	445	420	[a] 395	400	460	520	1,080	1,210	1.720	760	710	[a] 680
20	445	[a] 425	395	400	430	470	[a] 1,030	1,210	970	[a] 755	705	680
21	450	425	395	[a] 400	[a] 405	470	895	1,210	[a] 870	755	700	685
22	450	420	395	400	405	470	860	1,150	870	760	[a] 700	685
23	450	420	395	400	405	[a] 420	830	1,090	865	765	700	690
24	450	[a] 415	395	400	405	420	800	970	865	770	700	695
25	450	415	395	400	400	465	765	970	860	780	700	700
26	[a] 450	420	[a] 395	[a] 400	400	465	[a] 730	970	855	740	700	705
27	450	[a] 420	395	390	400	465	740	970	855	720	700	710
28	450	420	395	380	400	415	700	970	850	720	700	715
29	445	.....	395	[a] 400	400	[a] 410	710	970	[a] 850	720	700	720
30	[a] 445	.....	[a] 395	400	400	410	770	970	810	[a] 720	[a] 700	680
31	445	.....	395	.....	400	.....	[a] 720	915	.....	720	.....	685

[a] Dates of measurements.

Monthly discharge of Devils River at Devils River, Tex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	505	445	456	28,036
February	440	415	421	23,405
March	425	365	395	24,307
April	535	350	401	23,871
May	460	390	403	24,754
June	3,260	400	772	45,937
July	6,770	410	1,329	81,699
August	30,000	805	2,743	168,634
September	1,720	810	926	55,121
October	960	720	793	48,783
November	730	700	713	42,417
December	720	680	697	42,833
The year	30,000	350	837	609,797

SAN FELIPE CREEK DRAINAGE BASIN.

SAN FELIPE CREEK AT DEL RIO, TEX.

San Felipe Creek rises in four large springs northeast of Del Rio and flows southward into the Rio Grande. The waters of these springs are used in two large irrigation systems, the one on the west side of the creek having been in use for many years and the one on the east having been more recently constructed. The following table shows the discharge measurements that have been taken on the combined flow of the Madre ditch and the creek just south of the bridge of the Southern Pacific Railroad:

Discharge measurements of San Felipe Creek at Del Rio, Tex., 1895–1906.

Date.	Hydrographer.	Discharge.	Remarks.
		Sec.-ft.	
December, 1895	C. C. Babb	99	
March, 1899	T. U. Taylor	113	
September, 1900	do	149	Rainy season.
December, 1901	C. N. Campbell	150	After Brackett flood.
September, 1902	T. U. Taylor	115	
March, 1904	do	118	Includes 38 second-feet in ditch.
August, 1905	do	103	
April, 1906	do	72	Includes 34 second-feet in ditch.

LAS MORAS CREEK DRAINAGE BASIN.

LAS MORAS CREEK NEAR BRACKETTVILLE, TEX.

Las Moras Creek, like its sister springs of the Edwards Plateau, rises very suddenly. It is located near the twin towns of Brackettville and Fort Clark, and threads its way between the two. It flows south, supporting many irrigation systems, and finally empties into the Rio Grande 25 miles above Eagle Pass. Its flow is extremely variable, being a reflex barometer of the season preceding, and, like the Leona at Uvalde, it gives a safe index of the rainfall of the Edwards Plateau for months before. The following table shows the discharge measurements that have been taken:

Discharge measurements of Las Moras Creek near Brackettville, Tex., 1895–1906.

Date.	Hydrographer.	Discharge.	Remarks.
		Sec.-ft.	
December, 1895	C. C. Babb	21	At foot bridge, Brackettville.
June, 1899	T. U. Taylor	60	At Mulligans Bend.
September, 1900	do	51	Do.
September, 1902	do	11	Do.
September, 1902	do	11	Do.
March, 1904	do	28	Do.
August, 1905	do	14	Do.
April, 1906	do	18	Do.

MISCELLANEOUS MEASUREMENTS.

The following miscellaneous discharge measurements were made in the Rio Grande drainage basin in New Mexico in 1906:

Miscellaneous measurements in Rio Grande drainage basin in New Mexico in 1906.

Date.	Stream.	Locality.	Width.	Area of section.	Discharge.
			Feet.	*Sq. ft.*	*Sec.-ft.*
June 10	Black River	Malaga	7.5	4.4	8.5
June 10	do	Johnson's ranch, near Malaga	4.5	3.5	7.6
June 29	do	Keenan's ranch	2.4	0.56	0.59
June 29	do	Blue Spring ranch	5.2	3.74	3.77
August 2	do	Above Blue Spring ranch	4.5	4.3	3.7
June 29	East ditch	Blue Spring ranch	9.5	9.3	14.4
August 2	do	do	10.0	12.9	15.4
June 29	Smith Branch	Tullis ranch	3.4	1.48	0.83
August 2	do	do	4.5	2.3	2.43
June 29	Smith ditch	do	5.9	4.09	2.17
August 2	do	do	4.5	2.14	0.77
August 2	Spillway on dam	Blue Spring ranch	10.0	1.5	0.6
June 29	West ditch	do	7.0	6.0	2.09
August 2	do	do	7.0	8.4	2.0
June 7	West Valley ditch	Pecos, Tex	6.0	9.0	12.0

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[Water-Supply Paper No. 210.]

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1888. Tenth Annual Report, Part II*.
1889. Eleventh Annual Report, Part II*.
1890. Twelfth Annual Report, Part II*.
1891. Thirteenth Annual Report, Part III*.
1892. Fourteenth Annual Report, Part II*.
1893. Bulletin No. 131*.
1894. Bulletin No. 131*; Sixteenth Annual Report, Part II*.
1895. Bulletin No. 140*.
1896. Water-Supply Paper No. 11*; Eighteenth Annual Report, Part IV*.
1897. Water-Supply Papers Nos. 15* and 16*; Nineteenth Annual Report, Part IV*.
1898. Water-Supply Papers Nos. 27* and 28*; Twentieth Annual Report, Part IV*.
1899. Water-Supply Papers Nos. 35*, 36*, 37*, 38*, and 39*; Twenty-first Annual Report, Part IV*.
1900. Water-Supply Papers Nos. 47, 48, 49, 50, 51, and 52; Twenty-second Annual Report, Part IV.
1901. East of Mississippi River, Water-Supply Papers Nos. 65* and 75*.
West of Mississippi River, Water-Supply Papers Nos. 66 and 75*.

1902. East of Mississippi River, Water-Supply Papers Nos. 82 and 83.
West of Mississippi River, Water-Supply Papers Nos. 84 and 85.
1903. East of Mississippi River, Water-Supply Papers Nos. 97 and 98.
West of Mississippi River, Water-Supply Papers Nos. 99 and 100.
1904. East of Mississippi River, Water-Supply Papers Nos. 124, 125, 126, 127, 128, and 129.
West of Mississippi River, Water-Supply Papers Nos. 130, 131, 132, 133, 134, and 135.
1905. East of Mississippi River, Water-Supply Papers Nos. 165*, 166*, 167, 168*, 169, 170, and 171.
West of Mississippi River, Water-Supply Papers Nos. 171, 172*, 173*, 174, 175*, 176, 177, and 178.
1906. East of Mississippi River, Water-Supply Papers Nos. 201, 202, 203, 204, 205, 206, and 207.
West of Mississippi River, Water-Supply Papers Nos. 207, 208, 209, 210, 211, 212, 213, and 214.

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Washington, D. C.

September, 1907.

O

Water-Supply Paper No. 211

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

SURFACE WATER SUPPLY OF COLORADO RIVER DRAINAGE ABOVE YUMA

1906

R. I. MEEKER
H. S. REED
DISTRICT HYDROGRAPHERS

WASHINGTON
GOVERNMENT PRINTING OFFICE
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SURFACE WATER SUPPLY OF THE COLORADO RIVER DRAINAGE ABOVE YUMA.[a]

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INTRODUCTION.

SCOPE OF WORK.

The water supply of the United States is of more importance to the life and pursuits of the people than any other natural resource. In the arid States the limit of agricultural development is determined by the amount of water available for irrigation, while in all parts of the country the increase in the population of cities and towns makes necessary additional water supplies for domestic and industrial uses, in procuring which both the quantity and the quality of the water that may be obtained must be considered. The location of manufacturing plants may depend largely on the water-power facilities and on the character of the water. The notable advances made in the electric transmission of power have led to the utilization of water powers for the operation of manufacturing establishments, railroads, and municipal lighting plants, many of which are at some distance from the places at which the power is developed.

The intelligent establishment and maintenance of enterprises or industries that depend on the use of water demands a thorough knowledge of the flow of the streams and an understanding of the conditions affecting that flow. This knowledge should be based on data showing both the total flow and the distribution of the flow throughout the year, in order that normal fluctuations may be provided for. As the flow of a stream is variable from year to year, estimates of future flow can be made only from a study of observations covering several years. The rapid increase in the development of the water

[a] This report contains information similar to that published in previous years under the title "Report on the Progress of Stream Measurements."

resources of the United States has caused a great demand by engineers for information in regard to the flow of streams, as it is now generally realized that the failure of many large power, irrigation, and other projects has been due to the fact that the plans were made without sufficient trustworthy information in respect to the water supply.

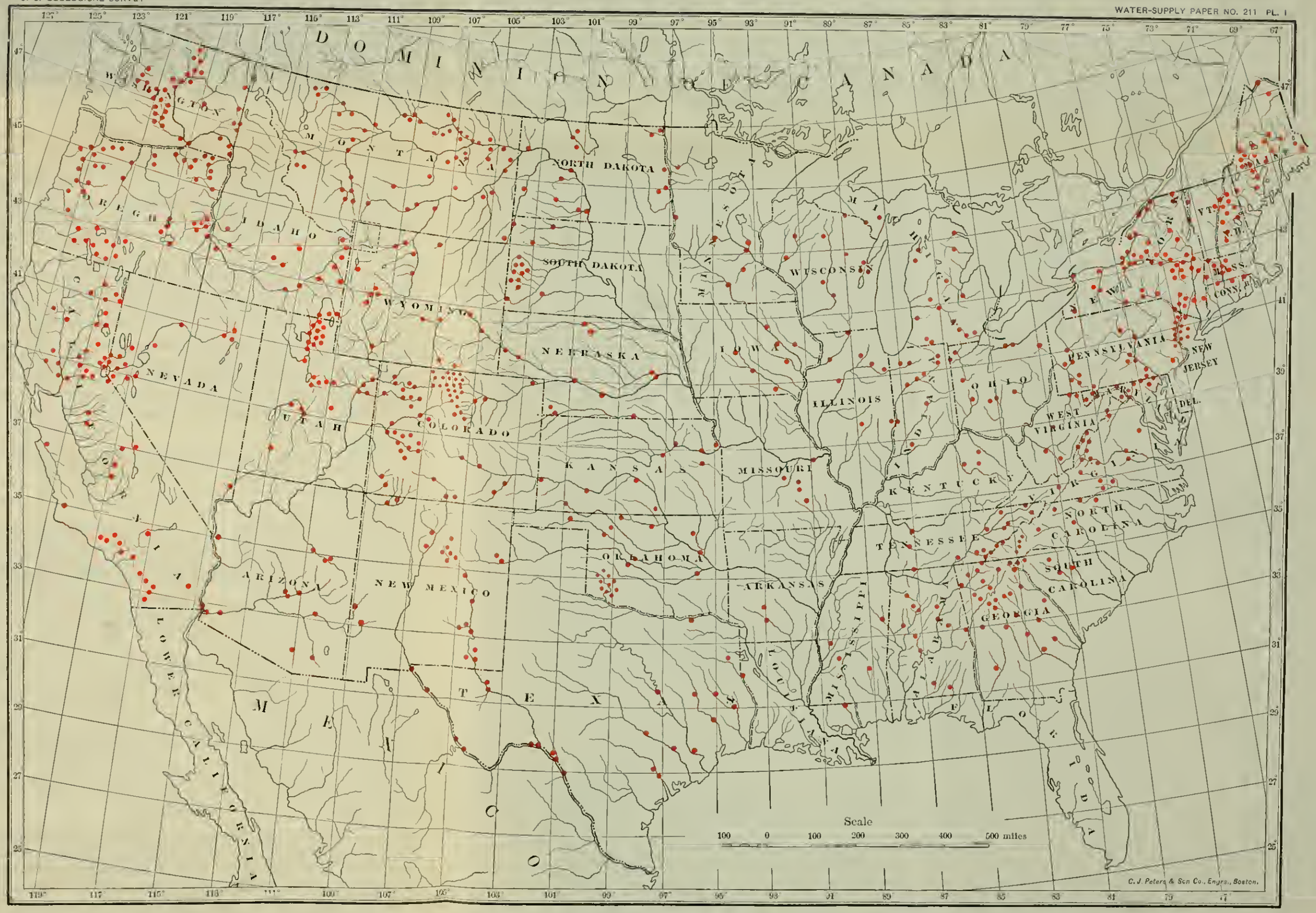
Owing to the broad scope of these hydrographic investigations and the length of time they should cover in order that the records may be of greatest value, it is in general impossible for private individuals to collect the necessary data, and as many of the streams traverse more than one State this work does not properly fall within the province of the State authorities. The United States Geological Survey has, therefore, by means of specific appropriations by Congress, for several years systematically made records of stream flow, with the view of ultimately determining all the important features governing the flow of the principal streams of the country. In carrying out this plan stations are established on the streams and maintained for a period long enough to show their regimen or general behavior. When a record that is sufficient for this purpose has been obtained for any stream, the work on that stream is discontinued. The order in which the streams are measured is determined by the degree of their importance.

During 1906 the regimen of flow was studied at about 700 stations distributed along the various rivers throughout the United States, as shown on Pl. I. In addition to these records data in regard to precipitation, evaporation, water power, and river profiles were obtained in many sections of the country.

These data have been assembled by drainage areas and are published in a series of fourteen Water-Supply and Irrigation Papers, Nos. 201 to 214, inclusive, each of which pertains to the surface water resources of a group of adjacent areas. In these papers are embodied not only the data collected in the field, but also the results of computations based on these data and other information that has a direct bearing on the subject, such as descriptions of basins and the streams draining them, utility of the water resources, etc. The list follows.

Water-Supply and Irrigation Papers on surface water supply, 1906.

201. Surface water supply of New England, 1906. (Atlantic coast of New England drainage.)
202. Surface water supply of the Hudson, Passaic, Raritan, and Delaware river drainages, 1906.
203. Surface water supply of the Middle Atlantic States, 1906. (Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages.)
204. Surface water supply of the Southern Atlantic and Eastern Gulf States, 1906. (Santee, Savannah, Ogeechee, and Altamaha rivers, and eastern Gulf of Mexico drainages.)
205. Surface water supply of the Ohio and lower eastern Mississippi river drainages, 1906.



MAP OF UNITED STATES SHOWING LOCATION OF PRINCIPAL RIVER STATIONS MAINTAINED DURING 1906.

206. Surface water supply of the Great Lakes and St. Lawrence River drainages, 1906.
207. Surface water supply of the upper Mississippi River and Hudson Bay drainages, 1906.
208. Surface water supply of the Missouri River drainage, 1906.
209. Surface water supply of the lower western Mississippi River drainage, 1906.
210. Surface water supply of the western Gulf of Mexico and Rio Grande drainages, 1906.
211. Surface water supply of the Colorado River drainage above Yuma, 1906.
212. Surface water supply of the Great Basin drainage, 1906.
213. Surface water supply of California, 1906. (The Great Basin and Pacific Ocean drainages in California and Colorado River drainage below Yuma.)
214. Surface water supply of the North Pacific Coast, 1906.

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing such records up to and including 1903 has been published in Water-Supply Paper No. 119. The following table gives, by years and primary drainage basins, the numbers of the papers on surface water supply published from 1901 to 1906:

Numbers of Water-Supply Papers containing results of stream measurements, 1901–1906.[a]

	1901.	1902.	1903.	1904.	1905.	1906.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
Atlantic coast of New England drainage	65 75	82	97	124	165	201
Hudson, Passaic, Raritan, and Delaware river drainages	65 75	82	97	125	166	202
Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages	65 75	82 83	97 98	126	167	203
Santee, Savannah, Ogeechee, and Altamaha rivers and eastern Gulf of Mexico drainages	65 75	83	98	127	168	204
Ohio and lower eastern Mississippi river drainages	65 75	83	98	128	169	205
Great Lakes and St. Lawrence River drainages	65	83	97	129	170	206
Hudson Bay and upper eastern and western Mississippi River drainages	65 66 75	83 84 85	98 99 100	128 130	171	207
Missouri River drainage	66 75	84	99	130 131	172	208
Meramec, Arkansas, Red, and lower western Mississippi river drainages	66 75	84	99	131	173	209
Western Gulf of Mexico and Rio Grande drainages	66 75	84	99	132	174	210
Colorado River drainage, above Yuma	66 75	85	100	133	175	211
The Great Basin drainage	66 75	85	100	133	176	212
The Great Basin and Pacific Ocean drainages in California, and Colorado River drainage, below Yuma	66 75	85	100	134	177	213
North Pacific Coast drainage	66 75	85	100	135	178	214

[a] Reports containing data for years prior to 1901 are noted in the series list at the end of this paper

DEFINITIONS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups: (1) Those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet per square mile, and (2) those which represent the actual quantity of water,

as run-off in depth in inches and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the quantity of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed.

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the quantity of water that passes through an orifice 1 inch square under a head which varies locally. It has been commonly used by miners and irrigators throughout the West and is defined by statute in each State in which it is used.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

"Acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. It is commonly used in connection with storage for irrigation work. There is a convenient relation between the second-foot and the acre-foot: One second-foot flowing for twenty-four hours will deliver 86,400 cubic feet, or approximately 2 acre-feet.

EXPLANATION AND USE OF TABLES.

For each regular gaging station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of monthly and yearly discharges and run-off.
6. Tables showing discharge and horsepower and the number of days during the year when the same are available.

The descriptions of stations give such general information about the locality and equipment as would enable the reader to find and use the station, and they also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, name of the

hydrographer, width and area of cross section, gage height, and discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. At most stations the gage is read in the morning and in the evening.

The discharge measurements and gage heights are the base data from which the other tables are computed. In cases of extensive development it is expected that engineers will use these original data in making their calculations, as the computations made by the Survey are based on the data available at the time they are made and should be reviewed and, if necessary, revised when additional data are available.

The rating table gives the discharge in second-feet corresponding to various stages of the river as given by the gage heights. It is published to enable engineers to determine the daily discharge in case this information is desired.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow for each second during the month. Upon this the computations for the remaining columns, which are defined on page 4, are based.

The values in the table of monthly discharge are intended to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates.

In most work where data in regard to flow are used the regimen of flow is of primary importance. Therefore for the principal stations tables have been prepared showing the horsepower that can be developed at various rates of flow, and the length of time that these rates of flow and the corresponding horsepower are available. These tables have been prepared on a basis of 80 per cent efficiency on the turbines, and the horsepower per foot of fall is given in order that the reader can determine the horsepower for any fall.

In the computations sufficient significant figures have been used so that the percentage of error in the tables will not in general exceed 1 per cent. Therefore, most of the values in the tables are given to only three significant figures. In making the various computations Thatcher's slide rule, Crelle's tables, and computation machines have been generally used.

In order to give engineers an idea of the relative value of the various data notes in regard to accuracy are given as far as possible. This accuracy depends on the general local conditions at the gaging stations and the amount of data collected. Every effort possible is made to so locate the stations that the data collected will give a high degree of accuracy. This is not always possible, but it is considered better to publish rough values with explanatory notes rather than no data.

In the accuracy notes the following terms have been used, indicating the probable accuracy, in per cent, of the mean monthly flow. As these values are mean values, the error in the value for the flow of any individual day may be much larger.

Excellent indicates that the mean monthly flow is probably accurate to within 5 per cent; good, to within 10 per cent; fair, to within 15 per cent; approximate, to within 25 per cent.

CONVENIENT EQUIVALENTS.

Following is a table of convenient equivalents for use in hydraulic computations:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equal 18.7 United States gallons per second.
100 California miner's inches equal 96.0 Colorado miner's inches.
100 California miner's inches for one day equal 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches equal 104 California miner's inches.
100 Colorado miner's inches for one day equal 5.17 acre-feet.
100 United States gallons per minute equal 0.223 second-feet.
100 United States gallons per minute for one day equal 0.442 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 22.95 acre-feet.

1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
1⅓ horsepower equal about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel, realizing 80 per cent of theoretical power.

FIELD METHODS OF MEASURING STREAM FLOW.

The methods used in collecting these data and in preparing them for publication are given in detail in Water-Supply Papers No. 94 (Hydrographic Manual, U. S. Geol. Survey) and No. 95 (Accuracy of Stream Measurements). In order that those who use this report may readily become acquainted with the general methods employed, the following brief descriptions are given:

Streams may be divided, with respect to their physical conditions, into three classes: (1) Those with permanent beds; (2) those with beds which change only during extreme low or high water; and (3) those with constantly shifting beds. In determining the daily flow special methods are necessary for each class. The data on which the determinations are based and the methods of collecting them are, however, in general the same.

There are three distinct methods of determining the flow of open-channel streams: (1) By measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir, (3) by measurements of the velocity of the current and of the area of the cross section. The method chosen for any case depends on the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to the coefficients to be used in the Chezy formula, $v = c\sqrt{Rs}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The

results obtained by the slope method are in general only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value for n to be used in Kutter's formula. The most common use of this method is in estimating the flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions.

Weir method.—When funds are available and the conditions are such that sharp-crested weirs can be erected, these offer the best facilities for determining flow. If dams are suitably situated and constructed, they may be utilized for obtaining reliable measurements of flow. The conditions necessary to insure good results may be divided into two classes: (1) Those relating to the physical characteristics of the dam itself, and (2) those relating to the diversion and use of water around and through the dam.

The physical requirements are as follows: (*a*) Sufficient height of dam, so that backwater will not interfere with free fall over it; (*b*) absence of leaks of appreciable magnitude; (*c*) topography or abutments which confine the flow over the dam at high stages; (*d*) level crests which are kept free from obstructions caused by floating logs or ice; (*e*) crests of a type for which the coefficients to be used in $Q=c\ b\ h^{\frac{3}{2}}$, or some similar standard weir formula, are known (see Water-Supply Papers Nos. 180 and 200[a]); (*f*) either no flashboards or exceptional care in reducing leakage through them and in recording their condition.

Preferably there should be no diversion of water through or around the dam. Generally, however, the dam is built for purposes of power or navigation, and part or all of the water flowing past it is diverted for such uses. This water is measured and added to that passing over the dam. To insure accuracy in such determinations of flow, the amount of water diverted should be reasonably constant. Furthermore, it should be so diverted that it can be measured, either by a weir, a current meter, or a simple system of water wheels which are of standard make, or which have been rated as meters under working conditions and so installed that the gate openings, the heads under which they work, and their angular velocities may be accurately observed.

The combination of physical conditions and uses of the water should be such that the determinations of flow will not involve, for a critical stage of considerable duration, the use of a head on a broad-crested dam of less than 6 inches. Moreover, when all other conditions are good, the cooperation of the owners or operators of the plant is still essential if reliable results are to be obtained.

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[a] Water-Supply Paper No. 200 replaces No. 150, the edition of which has been exhausted.

A gaging station at a weir or dam has the general advantage of continuity of record through the period of ice and floods and the disadvantages of uncertainty of coefficient to be used in the weir formula and of complications in the diversion and use of the water.

Velocity method.—The determination of the quantity of water flowing past a certain section of a stream at a given time is termed a discharge measurement. This quantity is the product of two factors—the mean velocity and the area of the cross section. The mean velocity is a function of surface slope, wetted perimeter, roughness of bed, and the channel conditions at, above, and below the gaging section. The area depends on the contour of the bed and the fluctuations of the water surface. The two principal ways of measuring the velocity of a stream are by floats and current meters.

Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements, in order that the data may have the required degree of accuracy. Their essential requirements are practically the same, whether the velocity is determined by meters or floats. They are located, as far as possible, where the channel is straight both above and below the gaging section; where there are no cross currents, backwater, or boils; where the bed of the stream is reasonably free from large projections of a permanent character, and where the banks are high and subject to overflow only at flood stages. The station must be so far removed from the effects of tributary streams and of dams or other artificial obstructions that the gage height shall be an index of the discharge.

Certain permanent or semipermanent structures, usually referred to as "equipment," are generally pertinent to a gaging station. These are a gage for determining the fluctuations of the water surface, bench marks to which the datum of the gage is referred, permanent marks on a bridge or a tagged line indicating the points of measurement, and, where the current is swift, some appliance (generally a secondary cable) to hold the meter in position in the water. As a rule the stations are located at bridges if the channel conditions are satisfactory, as from them the observations can more readily be made and the cost of the equipment is small.

The floats in common use are the surface, subsurface, and tube or rod floats. A corked bottle with a flag in the top and weighted at the bottom makes one of the most satisfactory surface floats, as it is affected but little by wind. In case of flood measurements good results can be obtained by observing the velocity of floating cakes of ice or débris. In case of all surface-float measurements coefficients must be used to reduce the observed velocity to the mean velocity. The subsurface and tube or rod floats are intended to give directly the mean velocity in the vertical. Tubes give excellent results when the channel conditions are good, as in canals.

In measuring velocity by a float, observation is made of the time taken by the float to pass over the "run," a selected stretch of river from 50 to 200 feet long. In each discharge measurement a large number of velocity determinations are made at different points across the stream, and from these observations the mean velocity for the whole section is determined. This may be done by plotting the mean positions of the floats, as indicated by the distances from the bank, as ordinates and the corresponding times as abscissas. A curve through these points shows the mean time of run at any point across the stream, and the mean time for the whole stream is obtained by dividing the area bounded by this curve and its axis by the width. The length of the run divided by the mean time gives the mean velocity.

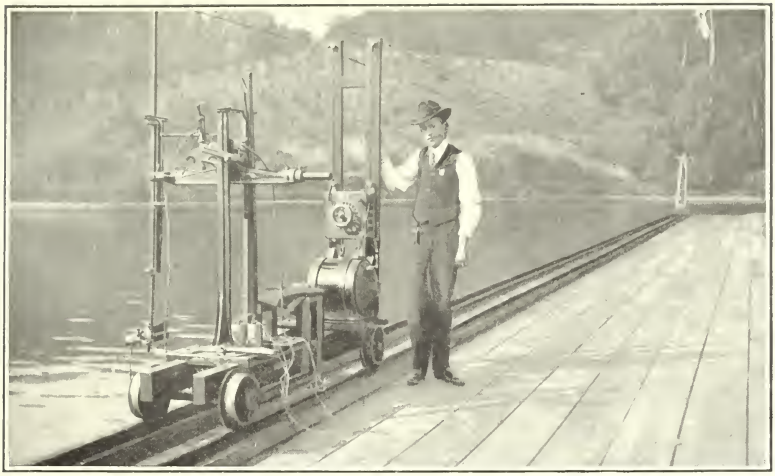
The area used in float measurements is the mean of the areas at the two ends of the run and at several intermediate sections.

The essential parts of the current meters in use are a wheel of some type, so constructed that the impact of flowing water causes it to revolve, and a device for recording or indicating the number of revolutions. The relation between the velocity of the moving water and the revolutions of the wheel is determined for each meter. This rating is done by drawing the meter through still water for a given distance at different speeds and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity per second for any number of revolutions.

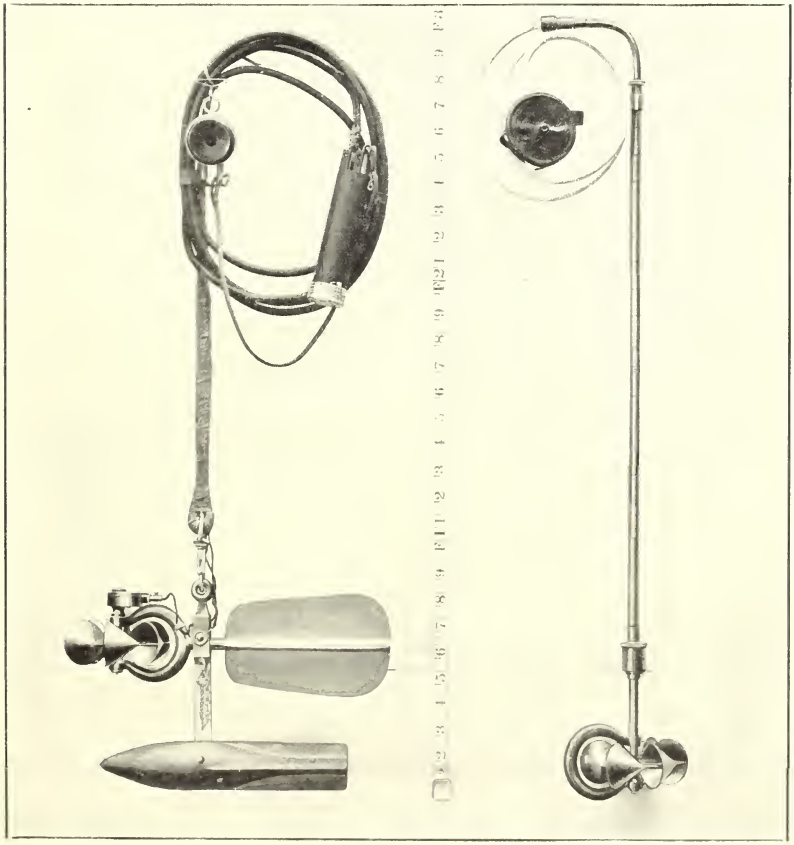
Many kinds of current meters have been constructed. They may, however, be classed in two general types—those in which the wheel is made up of a series of cups, as the Price, and those having a screw-propeller wheel, as the Haskell. Each meter has been developed for use under some special condition. In the case of the small Price meter, shown in Pl. II, *B*, which has been largely developed and extensively used by the United States Geological Survey, an attempt has been made to get an instrument which could be used under practically all conditions.

Current-meter measurements may be made from a bridge, cable, boat, or by wading, and gaging stations may be classified in accordance with such use. Fig. 1 shows a typical cable station.

In making the measurement an arbitrary number of points are laid off on a line perpendicular to the thread of the stream. The points at which the velocity and depth are observed are known as measuring points, and are usually fixed at regular intervals, varying from 2 to 20 feet, depending on the size and condition of the stream. Perpendiculars dropped from the measuring points divide the gaging section into strips. For each strip or pair of strips the mean velocity, area, and discharge are determined independently, so that conditions existing



A. CURRENT-METER RATING STATION, LOS ANGELES, CAL.



B. PRICE CURRENT METERS.

in one part of the stream may not be extended to parts where they do not apply.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

The three principal multiple-point methods in general use are the vertical velocity-curve; 0.2 and 0.8 depth; and top, bottom, and mid-depth.

In the vertical velocity-curve method a series of velocity determinations are made in each vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve among the resulting points, the vertical velocity-curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity-curve and its axis by the depth. On account of the length of time required to

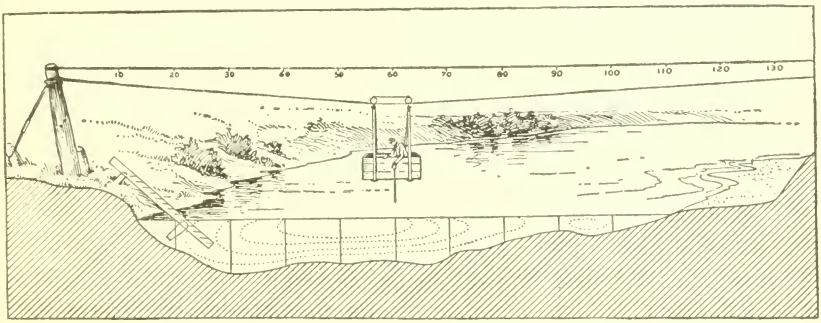


FIG. 1.—Cable station, showing section of river, car, gage, etc.

make a complete measurement by this method, its use is limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 of the depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity-curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 of the depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this second multiple-point method gives the mean velocity very closely for open-water conditions, and moreover the indications are that it holds nearly as well for ice-covered rivers.

In the third multiple-point method the meter is held at mid-depth, at 0.5 foot below the surface, and at 0.5 foot above the bottom, and the mean velocity is determined by dividing by 6 the sum of the top

velocity, four times the mid-depth velocity, and the bottom velocity. This method may be modified by observing at 0.2, 0.6, and 0.8 depth.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity, or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined.

Extensive experiments by vertical velocity-curves show that the thread of mean velocity generally occurs at from 0.5 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, at which point the meter is held in a majority of the measurements. A large number of vertical velocity-curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be from 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is specially adapted for flood measurements, or when the velocity is so great that the meter can not be kept at 0.6 depth.

The vertical-integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface, and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods.

The area, which is the other factor in the velocity method of determining the discharge of a stream, depends on the stage of the river, which is observed on the gage, and on the general contour of the bed of the stream, which is determined by soundings. The soundings are usually taken at each measuring point at the time of the discharge measurement, either by using the meter and cable or by a special sounding line or rod. For streams with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also of value in obtaining the area for use in computations of high-water measurements, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at various points of measurement, the measuring section is divided into elementary strips, as shown in fig. 1, and the mean velocity, area, and discharge are determined separately for either

a single or a double strip. The total discharge and the area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8, and vertical velocity-curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, the thickness and character of the ice, etc.

From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice. For information in regard to flow under ice cover see Water-Supply Paper No. 187.

OFFICE METHODS OF COMPUTING RUN-OFF.

There are two principal methods of determining run-off, depending on whether or not the bed of the stream is permanent.

For stations on streams with permanent beds the first step in computing the run-off is the construction of a rating table, which shows the discharge corresponding to any stage of the stream. This rating table is applied to the record of stage to determine the amount of water flowing. The construction of the rating table depends on the method used in measuring flow.

For a station at a weir or dam the basis for the rating table is some standard weir formula. The coefficients to be used in its application depend on the type of dam and other conditions near its crest. After inserting in the weir formula the measured length of crest and the assumed coefficient the discharge is computed for various heads and the rating table constructed.

The data necessary for the construction of a rating table for a velocity-area station are the results of the discharge measurements, which include the record of stage of the river at the time of measurement, the area of the cross section, the mean velocity of the current, and the quantity of water flowing. A thorough knowledge of the conditions at and in the vicinity of the station is also necessary.

The construction of the rating table depends on the following laws of flow for open, permanent channels: (1) The discharge will remain constant so long as conditions at or near the gaging station remain constant; (2) the discharge will be the same whenever the stream is at a given stage if the change of slope due to the rise and fall of the stream be neglected; (3) the discharge is a function of and increases gradually with the stage.

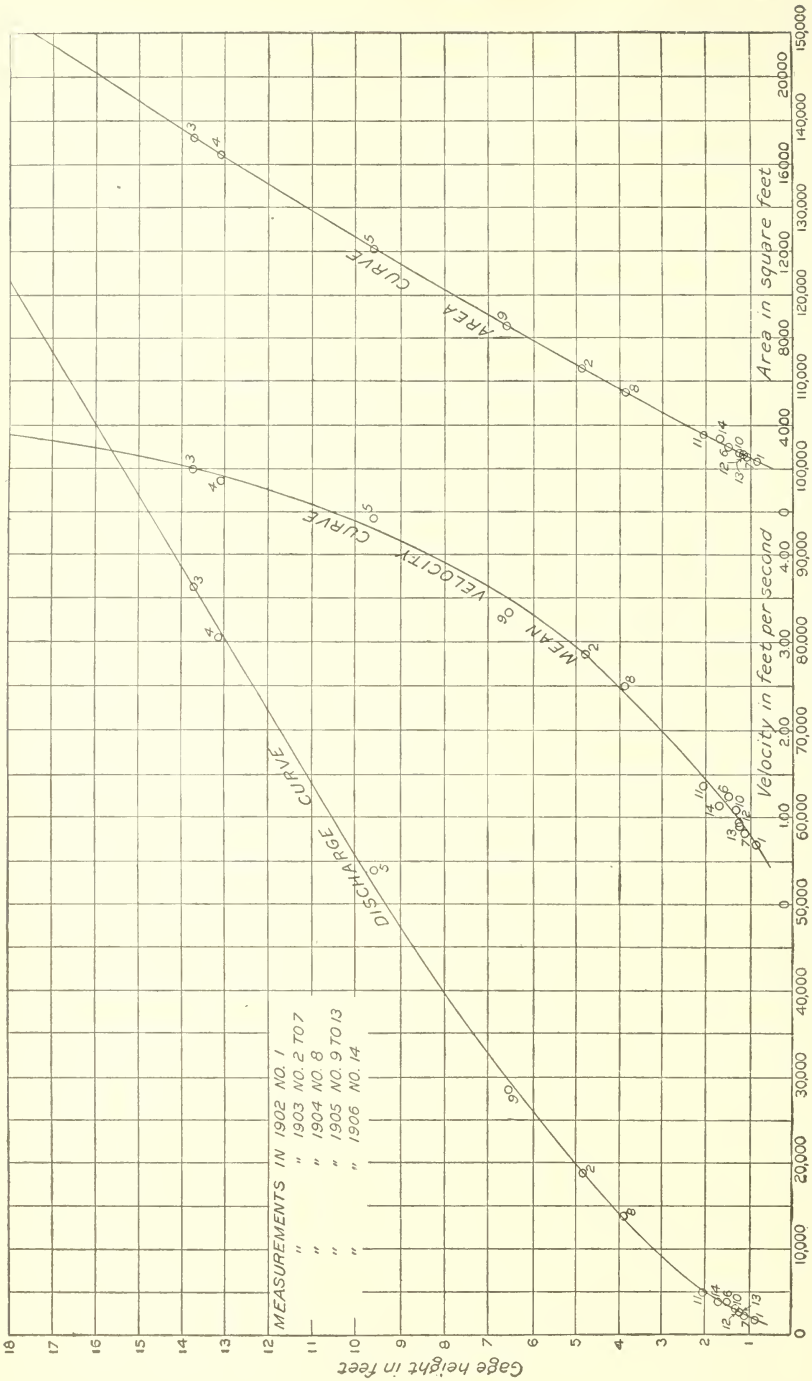


FIG. 2.—Discharge, area, and mean-velocity curves for Potomac River at Point of Rocks, Md.

The plotting of results of the various discharge measurements, using gage heights as ordinates, and discharge, mean velocity, and area as abscissas, will define curves which show the discharge, mean velocity, and area corresponding to any gage height. For the development of these curves there should be, therefore, a sufficient number of discharge measurements to cover the range of the stage of the stream. Fig. 2 shows a typical rating curve with its corresponding mean-velocity and area curves.

As the discharge is the product of two factors, the area and the mean velocity, any change in either factor will produce a corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate soundings extending to the limits of high water. It is always concave toward the horizontal axis or on a straight line, unless the banks of the stream are overhanging.

The form of the mean-velocity curve depends chiefly on the surface slope, the roughness of the bed, and the cross section of the stream. Of these, the slope is the principal factor. In accordance with the relative changes of these factors the curve may be either a straight line, convex or concave toward either axis, or a combination of the three. From a careful study of the conditions at any gaging station the form which the vertical-velocity curve will take can be predicted, and it may be extended with reasonable certainty to stages beyond the limits of actual measurements. Its principal use is in connection with the area curve in locating errors in discharge measurements and in constructing the rating table.

The discharge curve is defined primarily by the measurements of discharge, which are studied and weighted in accordance with the local conditions existing at the time of each measurement. The curve may, however, best be located between and beyond the measurements by means of curves of area and mean velocity. The discharge curve under normal conditions is concave toward the horizontal axis and is generally parabolic in form.

In the preparation of the rating table the discharge for each tenth or half tenth on the gage is taken from the curve. The differences between successive discharges are then taken and adjusted according to the law that they shall either be constant or increasing.

The determination of daily discharge of streams with changeable beds is a difficult problem. In case there is a weir or dam available, a condition which seldom exists on streams of this class, the discharge can be determined by its use. In case of velocity-area stations frequent discharge measurements must be made if the determinations of flow are to be other than rough approximations. For stations with beds which shift slowly or are materially changed only during floods

rating tables can be prepared for periods between such changes and satisfactory results obtained with a limited number of measurements, provided that some of them are taken soon after the change occurs. For streams with continually shifting beds, such as the Colorado and Rio Grande, discharge measurements should be made every two or three days and the discharges for intervening days obtained either by interpolation modified by gage height or by Professor Stout's method, which has been described in full in the Nineteenth Annual Report of the United States Geological Survey, Part IV, page 323, and in the Engineering News of April 21, 1904. This method, or a graphical application of it, is also much used in determining the flow at stations where the bed shifts but slowly.

ACKNOWLEDGMENTS.

Assistance has been rendered and records furnished by the following, to whom special acknowledgment is due: United States Reclamation Service, United States Weather Bureau, State engineer of Colorado, State engineer of Utah, Denver Union Water Company, Central Colorado Power Co.; and the following railroad companies: Denver and Rio Grande; Oregon Short Line; San Pedro, Los Angeles and Salt Lake; Colorado and Southern; Union Pacific; and Burlington.

COLORADO RIVER DRAINAGE BASIN.

GENERAL DESCRIPTION.

Colorado River is formed in the southeastern part of Utah by the junction of Grand and Green rivers. The Green is larger than the Grand and is the upward continuation of the Colorado. Including the Green the entire length of the Colorado is about 2,000 miles. The region drained is about 800 miles long, varies in width from 300 to 500 miles, and contains about 300,000 square miles. It comprises the southwestern part of Wyoming, the western part of Colorado, the eastern half of Utah, practically all of Arizona, and small portions of California, Nevada, New Mexico, and old Mexico. Most of this area is arid, the mean annual rainfall being about 8½ inches. The streams receive their supply from the melting snows on the high mountains of Wyoming, Utah, and Colorado.

There are two distinct portions of the basin of the Colorado. The lower third is but little above the level of the sea, though here and there ranges of mountains rise to elevations of 2,000 to 6,000 feet. This part of the valley is bounded on the north by a line of cliffs which present a bold, often vertical, step of hundreds or thousands of feet to the table-land above. The upper two-thirds of the basin stands from 4,000 to 8,000 feet above sea level, and is bordered on the east, west, and north by ranges of snow-clad mountains which

attain altitudes varying from 8,000 to 14,000 feet above sea level. Through this plateau the Colorado and its tributaries have cut narrow gorges or canyons in which they flow at almost inaccessible depths. At points where lateral streams enter, the canyons are broken by narrow transverse valleys, diversified by bordering willows, clumps of box elder, and small groves of cottonwood. The whole upper basin of the Colorado is traversed by a labyrinth of these canyons, most of which are dry during the greater portion of the year, and carry water only during the melting of the snow and the brief period of the autumnal and spring rains.

As a matter of convenience the drainage area has been divided into three basins: (1) Green River basin, (2) Grand River basin, and (3) Colorado River below the junction of Grand and Green rivers, and each of these basins is subdivided to allow the separate description of branches of the main river.

GREEN RIVER DRAINAGE BASIN.

AREA AND EXTENT.

Green River and its tributaries drain an area rudely triangular in outline, bounded on the north and east by the Wind River Mountains and the ranges forming the Continental Divide, on the south and east by the White River Plateau and the Roan or Book Cliffs, and on the north and west by the Gros Ventre and Wyoming mountains and the great Wasatch Range. The greatest length of the basin, north and south, is about 370 miles. In an east-west direction it measures at its widest point about 240 miles. The total drainage area is approximately 41,000 square miles.

The area includes a large part of western Wyoming, northwestern Colorado, and eastern Utah. The Uinta and Uncompahgre Indian reservations are located in this basin in northeastern Utah.

As a matter of convenience the main river is described first and the tributary streams, beginning at the headwaters, afterwards.

GREEN RIVER.

DESCRIPTION OF BASIN.

Green River heads on the west slope of the Wind River Mountains in western Wyoming, its ultimate source being a number of small lakes fed by the glaciers and immense snow deposits always to be found on Fremont and neighboring peaks. For perhaps 25 miles the river flows northwestward through the mountains. It then turns abruptly and runs in a general southerly direction across western Wyoming into Utah. A few miles below the Wyoming-Utah boundary another sharp turn carries the river eastward along the Uinta

Mountains, through which it breaks near the east end of the range. It then flows southward in Colorado for about 25 miles, turns back into Utah, and continues to flow in a southwesterly and southerly direction until it unites with the Grand to form the Colorado. Its length, measured roughly along the course, is approximately 425 miles.

The topography of the headwater region is rugged in the extreme. The Wind River Range on the east and the Gros Ventre and Wyoming ranges on the northwest and west gradually close in as they extend southward, forming a basin comprising approximately 7,450 square miles in extent above the gaging station at Green River, Wyo. The upper part of this basin is very narrow, but southward the valley opens out; near Fontanelle, Wyo., it is several miles wide, with benches and rolling table-lands extending westward to the foothills of the Wyoming Range and eastward to the bluffs which hug the east bank of the river. At Green River the valley is again narrow—only a few hundred yards in width—and for some distance southward the river runs between bluffs standing so close together that no flood plain is seen. Throughout much of its course in Utah the Green flows through a succession of long, deep, narrow canyons, with walls ranging in height from a few hundred to as many thousand feet, separated by short valleys containing small tracts of arable lands.

In its upper course the Green receives as tributaries numerous streams heading in the Wind River, Gros Ventre, and Wyoming ranges of mountains, some of them extending so far back into the abrupt, ragged canyons that they dovetail with streams flowing in opposite directions. The most important of these tributaries are Newfork River, Big Sandy Creek, La Barge Creek, Fontanelle Creek, Black Fork, and Henry Fork. South of the Uinta Mountains the first large stream flowing into the Green is the Yampa, which comes in from the east at the point where the Green turns westward to reenter Utah after its southward journey in Colorado. Farther south Ashley Creek and Uinta and White rivers discharge their waters to the Green, Ashley Creek and the Uinta from the west and the White from the east. Below this point the only tributaries of importance are Minnie Maud Creek and San Rafael River, which enter from the west, the latter at a point about 32 miles above the junction of the Green and the Grand.

The geology of this basin is described in the Eleventh Annual Report of the United States Geological and Geographical Survey of the Territories for 1877, F. V. Hayden in charge, pages 509–646. Information in regard to the hydrography is contained in the first to fourth annual reports of the Reclamation Service and in other United States Geological Survey reports.

GREEN RIVER AT GREEN RIVER, WYO.

This station was established May 2, 1895, near the pump house at a point about 40 feet below the bridge of the Union Pacific Railroad, at Green River, Wyo. Since that date it has been maintained continuously, except for a few months during the winter and during the year 1900. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 14, where are given also references to publications that contain data for previous years.

Discharge measurements of Green River at Green River, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 4 [a]	A. J. Parshall	161	589	1.50	873
April 26	do	278	921	2.85	3,040
May 5	do	246	804	2.65	2,580
May 22	do	284	1,150	3.35	4,200
June 1	do	284	1,540	4.10	6,910
June 24	do	284	1,500	3.90	6,340
July 5	do	281	1,370	3.70	5,470
July 27	do	281	1,090	3.10	3,480

[a] Right channel frozen over, no flow.

Daily gage height, in feet, of Green River at Green River, Wyo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.85	2.42	4.15	3.58	2.80	2.38	1.40
2	1.60	2.58	3.78	3.42	2.78	2.38	1.35
3	1.62	2.55	3.58	3.35	2.68	2.38	1.35
4	1.65	2.55	3.42	3.50	2.60	2.30	1.30
5	1.52	2.72	3.42	3.68	2.58	2.25	1.30
6	1.85	3.00	3.50	3.75	2.50	2.25	1.30
7	1.75	2.92	3.75	3.75	2.50	2.12	1.25
8	1.90	2.85	3.90	3.85	2.42	2.02	1.25
9	2.05	2.85	3.72	3.90	2.32	1.92	1.22
10	1.95	2.88	3.50	3.90	2.30	1.88	1.20
11	2.40	2.98	3.40	3.85	2.22	1.80	1.20
12	2.25	3.22	3.48	3.82	2.12	1.80	1.20
13	2.25	3.58	3.95	3.80	2.10	1.75	1.18
14	2.60	3.88	4.48	3.80	2.10	1.75	1.15
15	2.55	4.00	5.08	3.90	2.08	1.82	1.15
16	2.30	3.95	5.38	3.90	2.05	1.90	1.15
17	2.45	3.90	5.28	3.82	2.02	1.90	1.15
18	2.80	3.70	5.30	3.72	2.00	1.82	1.15
19	2.85	3.52	5.22	3.55	2.00	1.78	1.10
20	2.75	3.32	4.82	3.42	1.98	1.70	1.10
21	2.60	3.22	4.40	3.32	2.25	1.65	1.10
22	2.70	3.35	4.15	3.22	2.35	1.60	1.20
23	3.00	3.58	3.85	3.15	2.50	1.60	1.30
24	2.90	3.80	3.90	3.15	2.78	1.55	1.40
25	2.90	4.10	3.88	3.20	3.08	1.55	1.40
26	2.85	4.35	3.70	3.18	3.25	1.50	1.30
27	2.80	4.45	3.55	3.08	3.18	1.50	1.30
28	2.58	4.45	3.45	3.05	3.00	1.45	1.30
29	2.40	4.50	3.45	2.95	2.82	1.42	1.22
30	2.42	4.55	3.52	2.82	2.68	1.40	1.12
31	.....	4.45	.....	2.75	2.42	.....	1.10

Rating table for Green River at Green River, Wyo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	560	1.90	1,290	2.70	2,630	3.50	4,830	4.60	8,900
1.20	635	2.00	1,410	2.80	2,860	3.60	5,160	4.80	9,730
1.30	710	2.10	1,540	2.90	3,100	3.70	5,500	5.00	10,570
1.40	790	2.20	1,690	3.00	3,360	3.80	5,850	5.20	11,430
1.50	875	2.30	1,850	3.10	3,630	3.90	6,210	5.40	12,290
1.60	965	2.40	2,020	3.20	3,910	4.00	6,570		
1.70	1,065	2.50	2,210	3.30	4,200	4.20	7,320		
1.80	1,175	2.60	2,410	3.40	4,510	4.40	8,100		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1906 and is well defined between gage heights 1.5 feet and 4.5 feet. It may not apply strictly from August to October, as conditions of flow may have changed after the last measurement.

Monthly discharge of Green River at Green River, Wyo., for 1906.

[Drainage area, 7,450 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	3,360	893	2,040	121,000	0.274	0.31
May	8,700	2,060	5,030	309,000	.675	.78
June	12,200	4,510	6,830	406,000	.917	1.02
July	6,210	2,740	4,860	299,000	.652	.75
August	4,060	1,390	2,240	138,000	.301	.35
September	1,990	790	1,260	75,000	.169	.19
October	790	560	660	40,600	.089	.10
The period				1,390,000		

NOTE.—Values are rated as follows: April to August, excellent; September and October, good.

GREEN RIVER AT JENSEN, UTAH.

This station was established November 7, 1903. It is located at Jensen post-office, about 300 feet below what is known as Billings Ferry, 15 miles from Vernal. The nearest railroad station, Dragon, Utah, is about 40 miles distant. Brush Creek enters the river 1½ miles above the station and Ashley Creek 3 miles below. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 17, where are given also references to publications that contain data for previous years.

Discharge measurements of Green River at Jensen, Utah, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 19	R. I. Meeker	475	2,580	6.63	7,500
June 4	do	530	4,750	9.95	20,100
June 26	do	520	4,030	8.41	14,300
July 21	T. E. Brick	399	2,860	6.10	8,620

Daily gage height, in feet, of Green River at Jensen, Utah, for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1		7.18	7.02	11.30	6.94	4.68	4.42
2		6.22	6.98	10.30	6.98	4.56	4.33
3		6.08	7.00	10.04	6.98	4.51	4.28
4		5.82	6.95	9.86	6.76	4.48	4.41
5		5.56	6.98	9.76	6.68	4.40	4.40
6		5.08	7.25	9.70	6.71	4.36	4.20
7		5.21	8.22	9.98	6.88	4.30	4.18
8		5.22	8.60	10.46	7.06	4.20	4.00
9		5.44	8.70	10.64	7.10	4.10	3.79
10		5.69	8.88	10.56	7.28	4.01	3.72
11		5.87	9.40	9.64	7.20	3.92	3.55
12		6.22	9.66	9.66	7.06	3.88	3.42
13	5.70	6.68	9.85	10.12	7.02	3.82	3.35
14	6.58	6.70	10.11	10.68	7.00	3.68	3.28
15	5.22	6.32	10.35	11.25	7.00	3.58	3.28
16	4.80	5.98	10.22	11.78	7.04	3.50	3.32
17	4.45	5.95	10.16	12.05	7.02	3.45	3.38
18	4.18	6.35	10.22	11.51	6.95	3.48	3.78
19	4.00	6.65	10.08	11.70	6.70	3.58	4.42
20	4.00	6.96	9.95	11.16	6.41	3.50	3.84
21	4.02	7.32	9.88	10.52	6.04	3.50	3.58
22	4.02	7.30	10.15	9.86	5.88	3.48	3.52
23	3.99	7.35	10.34	9.49	5.72	3.70	3.60
24	5.44	7.58	10.69	8.94	5.58	4.06	3.58
25	6.98	8.15	11.12	8.73	5.38	4.58	3.48
26	8.85	8.65	11.66	8.37	5.29	4.58	3.42
27	9.02	8.30	11.82	7.48	5.25	4.90	3.40
28	8.62	7.82	11.76	7.60	5.12	5.05	3.40
29	8.86	7.45	11.54	7.38	5.12	4.92	3.37
30	8.85	7.32	11.82	7.22	4.99	4.58	3.35
31	8.05	.....	11.92	.....	4.75	4.48	.....

Rating tables for Green River at Jensen, Utah.

MARCH 13 TO JULY 5, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.00	2,000	5.00	3,800	6.00	6,200	7.00	9,000	9.00	16,100
4.10	2,150	5.10	4,010	6.10	6,470	7.20	9,610	9.20	16,920
4.20	2,310	5.20	4,230	6.20	6,740	7.40	10,240	9.40	17,760
4.30	2,480	5.30	4,450	6.30	7,010	7.60	10,900	9.60	18,620
4.40	2,650	5.40	4,680	6.40	7,290	7.80	11,590	9.80	19,500
4.50	2,830	5.50	4,920	6.50	7,570	8.00	12,300	10.00	20,400
4.60	3,010	5.60	5,160	6.60	7,850	8.20	13,030	11.00	25,100
4.70	3,200	5.70	5,410	6.70	8,130	8.40	13,770	12.00	30,000
4.80	3,390	5.80	5,670	6.80	8,410	8.60	14,530		
4.90	3,590	5.90	5,930	6.90	8,700	8.80	15,310		

JULY 6 TO OCTOBER 31, 1906.[b]

3.30	2,270	4.00	3,550	4.70	5,050	5.40	6,740	6.20	8,920
3.40	2,440	4.10	3,750	4.80	5,280	5.50	7,000	6.40	9,510
3.50	2,610	4.20	3,960	4.90	5,510	5.60	7,260	6.60	10,120
3.60	2,790	4.30	4,170	5.00	5,750	5.70	7,530	6.80	10,750
3.70	2,970	4.40	4,380	5.10	5,990	5.80	7,800	7.00	11,400
3.80	3,160	4.50	4,600	5.20	6,240	5.90	8,070	7.20	12,060
3.90	3,350	4.60	4,820	5.30	6,490	6.00	8,350		

[a] This table is applicable only for open-channel conditions. It is based on 3 discharge measurements made during 1906, and the form of the 1904 curve, and is well defined between gage heights 6.5 feet and 10 feet. From March 13 to about April 15, it may give values a little in excess of the true discharge.

[b] This table is applicable only for open-channel conditions. It is based on 1 discharge measurement made during 1906 and the form of the 1904 curve. It is not well defined and values obtained from it are liable to error on account of changing conditions of flow.

Monthly discharge of Green River at Jensen, Utah, for 1906.

[Drainage area, 26,600 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March 13-31	16,200	1,990	7,340	276,000	0.276	0.19
April	14,700	3,970	8,070	480,000	.303	.34
May	29,600	8,850	19,400	1,190,000	.729	.84
June	30,200	9,670	20,400	1,210,000	.767	.86
July	12,300	5,160	9,230	568,000	.347	.40
August	5,870	2,520	3,850	237,000	.145	.17
September	4,420	2,240	3,080	183,000	.116	.13
The period				4,140,000		

NOTE.—Values are rated as follows: March to June, good; July to October, fair.

GREEN RIVER AT GREENRIVER, UTAH.

This station was established October 21, 1894, discontinued in November, 1896, and reestablished February 16, 1905. It is located at the Rio Grande Western Railway bridge at Greenriver (formerly Blake), Utah, in latitude 39° north, longitude 110° 9′ west, in the San Rafael quadrangle. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 19, where are given also references to publications that contain data for previous years. During 1906 the gage was read by W. E. Richards and G. C. Mead.

Discharge measurements of Green River at Greenriver, Utah, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 17	H. S. Kleinschmidt	462	2,770	6.60	10,400
May 17	E. C. Murphy	472	4,430	9.81	34,000
June 8	Thos. Grieve	472	4,440	9.80	33,600
June 29	do	466	3,820	8.50	22,600
October 19	do	400	1,780	4.60	3,170

Daily gage height, in feet, of Green River, at Greenriver, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.60	3.78	3.90	7.25	7.65	10.55	7.65	6.35	6.05	5.00	4.70	3.75
2	3.55	3.85	3.90	7.15	7.50	10.75	7.75	6.45	6.25	4.90	5.80	3.85
3	3.55	3.75	3.90	6.70	7.45	10.95	7.85	6.35	6.10	4.90	5.40	4.10
4	3.58	3.75	4.15	6.50	7.35	11.25	7.90	6.40	5.95	4.90	5.50	4.65
5	3.60	3.70	4.20	6.40	7.35	11.55	7.90	6.20	5.95	4.90	5.50	4.80
6	3.60	3.75	4.25	6.30	7.30	11.50	7.90	6.15	6.00	4.80	5.35	4.70
7	3.60	4.00	4.30	6.15	7.40	11.40	7.90	6.10	6.00	4.80	5.15	4.70
8	3.60	3.65	4.35	5.70	7.50	11.50	7.90	6.00	5.85	4.75	5.00	4.80
9	3.60	3.70	4.45	5.70	7.55	11.65	7.80	5.90	5.70	4.70	5.00	4.55
10	3.60	3.55	4.45	5.65	7.60	11.65	7.80	5.85	5.60	4.70	5.00	4.40
11	3.60	3.65	4.45	5.85	8.25	11.35	7.90	5.75	5.55	4.70	5.00	4.30
12	3.60	3.60	4.75	6.15	8.60	11.15	7.90	5.60	5.40	4.70	4.95	4.45
13	3.70	3.55	5.10	6.10	8.85	10.05	7.85	5.60	5.30	4.70	4.90	4.40
14	3.80	3.55	5.60	6.10	9.35	9.70	7.80	5.60	5.20	4.60	4.90	4.30
15	3.80	3.65	5.70	6.20	10.05	9.50	7.80	5.65	5.15	4.60	4.80	4.40

Daily gage height, in feet, of Green River, at Greenriver, Utah, for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	3.80	3.65	5.65	6.55	10.30	9.35	7.75	5.50	5.35	4.60	4.80	4.35
17	3.80	3.60	5.50	6.50	10.20	9.25	7.70	5.50	5.25	4.60	4.80	4.20
18	3.80	3.60	5.30	6.45	10.10	9.40	7.70	5.45	5.40	4.60	4.75	4.10
19	4.30	3.75	5.20	6.50	10.20	9.40	7.60	5.30	5.60	4.50	4.70	4.00
20	4.45	3.80	5.00	6.55	10.10	9.35	7.65	5.30	5.35	4.50	4.55	3.85
21	3.85	3.85	4.65	6.45	10.15	9.50	7.55	5.40	5.35	4.50	4.35	3.80
22	3.50	3.85	4.85	6.80	10.25	9.45	7.40	5.70	5.65	4.60	4.20	3.85
23	3.85	3.85	5.15	7.15	10.35	9.30	7.25	6.05	5.40	4.60	3.90	3.85
24	3.85	3.85	5.50	7.35	10.45	9.40	7.00	6.25	5.30	4.60	3.80	3.85
25	3.85	3.85	5.85	7.45	10.45	9.45	6.90	5.95	5.30	4.60	3.90	4.15
26	3.85	3.85	6.75	7.60	10.45	9.55	6.90	5.80	5.20	4.60	4.20	4.40
27	3.85	3.85	7.75	7.55	10.35	9.65	6.75	5.75	5.10	4.55	4.30	4.40
28	3.85	3.80	8.85	7.70	10.45	9.45	6.70	5.95	5.05	4.50	4.25	4.40
29	3.75	.....	8.65	8.10	10.60	9.25	6.60	6.00	5.00	4.40	4.05	4.50
30	3.78	.....	8.40	7.85	10.75	9.40	6.45	6.15	5.00	4.50	3.85	4.45
31	3.75	.....	8.05	.....	10.90	.....	6.40	6.05	.....	4.60	.....	4.60

NOTE.—There was probably some ice obstruction during January, February and March. During the high stages the gage heights obtained by the hydrographers do not agree with those recorded by the observer for the same dates. For this reason discharges based on the above high gage heights are liable to large error.

Rating table for Green River at Greenriver, Utah, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.50	1,390	4.60	3,140	5.70	6,480	6.80	11,470	8.80	25,080
3.60	1,510	4.70	3,370	5.80	6,870	6.90	12,000	9.00	26,780
3.70	1,640	4.80	3,610	5.90	7,270	7.00	12,550	9.20	28,500
3.80	1,770	4.90	3,870	6.00	7,680	7.20	13,700	9.40	30,240
3.90	1,910	5.00	4,150	6.10	8,110	7.40	14,910	9.60	32,000
4.00	2,050	5.10	4,440	6.20	8,550	7.60	16,180	9.80	33,800
4.10	2,200	5.20	4,740	6.30	9,010	7.80	17,510	10.00	35,600
4.20	2,360	5.30	5,060	6.40	9,480	8.00	18,900	11.00	45,040
4.30	2,530	5.40	5,390	6.50	9,960	8.20	20,340	12.00	55,000
4.40	2,720	5.50	5,740	6.60	10,450	8.40	21,840		
4.50	2,920	5.60	6,100	6.70	10,950	8.60	23,420		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 5 discharge measurements made during 1906 and the form of the 1905 curve. It is well defined between gage heights 4.5 feet and 10 feet.

Monthly discharge of Green River at Greenriver, Utah, for 1906.

[Drainage area, 38,200 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	2,820	1,450	1,720	106,000	0.045	0.05
February	2,050	1,450	1,690	93,900	.044	.05
March	25,500	1,910	6,970	429,000	.182	.21
April	19,600	6,290	11,200	666,000	.293	.33
May	44,100	14,300	29,500	1,810,000	.772	.89
June	51,500	28,900	37,600	2,240,000	.984	1.10
July	18,200	9,480	15,600	959,000	.408	.47
August	9,720	5,060	7,230	445,000	.189	.22
September	8,780	4,150	5,870	349,000	.154	.17
October	4,150	2,720	3,290	202,000	.086	.10
November	6,870	1,770	3,600	214,000	.094	.10
December	3,610	1,700	2,570	158,000	.067	.08
The year	51,500	1,450	10,600	7,670,000	.276	3.77

NOTE.—The above values must be used with a great deal of caution as they are considered only rough approximations. It is probable that the discharge for January, February, and March is much too high owing to ice conditions, for which no corrections could be made on account of lack of data. April and May can be considered approximate. June is known to be far too high (compare observers' and hydrographers' gage heights on days of measurements , and May is probably too high, also, but to a less extent. It is believed that the remainder of the year can be accepted as fair.

MISCELLANEOUS MEASUREMENTS IN GREEN RIVER DRAINAGE BASIN.

Fontenelle Creek is tributary to Green River about 50 miles above Green River, Wyo.

The following measurement was made May 31, 1906:

Width, 40 feet; area, 99 square feet; gage height, 3.05 feet; discharge, 374 second-feet.

NEWFORK RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Newfork River and its tributaries drain a portion of the western slopes of the Wind River Range, extending from Fremont Peak southeastward to Mount Bonneville, Mount Geikie, and Twin Buttes. The main stream flows in a general southerly course to a point near Cora, Wyo., where it turns sharply to the southwest, joining Green River about 40 miles below.

The entire length of the Newfork does not exceed 50 miles. The basin as a whole is triangular in shape and comprises approximately 1,100 square miles. Forests, in some places dense, cover about 300 square miles. Pines predominate, but aspens and firs are also found.

Pine, Pole, and Boulder creeks and Eastfork River are the chief tributaries of the Newfork. These are all small streams, heading far back among the high peaks of the range and fed by the numerous springs and small mountain lakes with which the region is dotted. Fremont, Boulder, Fayette, Half Moon, Burnt, and Meadow lakes are the largest and most important of these. Fremont Lake, through which Pine Creek flows, has an area of approximately 2,500 acres. The outlet is narrow and a dam at this point might be made to raise the water surface about 30 feet. Such a dam would probably store all the surplus waters of the creek. Boulder Creek flows through Boulder Lake. The outlet of this lake also is narrow, and a dam to raise the surface of the lake about 5 feet is in process of construction. In the drainage area of Pole Creek there are said to be no less than 40 small settling basins.

PINE CREEK NEAR PINEDALE, WYO.

This station was established on the stream April 25, 1904. It was located about one-fourth mile west of Pinedale, but this location not proving entirely satisfactory, it was abandoned at the close of the season, and April 2, 1905, was reestablished near the Hansen ranch, 1 mile above Pinedale, in sec. 28, T. 34 N., R. 109 W.

During 1906, discharge measurements were made from a bridge 1 mile below the gage, where the section is more favorable. During the irrigating season two ditches divert water from the river between the gage and the measuring section. The gage is read by Mrs. J. J. Hansen.

The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 23, where are given also references to publications that contain data for previous years.

Discharge measurements of Pine Creek near Pinedale, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 29	A. J. Parshall	35	47	1.20	52
May 2	do	45	60	1.25	71
May 25	do	92	143	2.00	378
May 29	do	96	165	2.30	574
June 16	G. N. Stadin	100	241	2.90	1,190
June 17	do	100	254	3.00	1,320
June 27	A. J. Parshall	98	198	2.45	[a] 739
July 2	do	98	196	2.40	[a] 704

[a] Includes discharge of two ditches which divert water between the gage and the measuring section.

Daily gage height, in feet, of Pine Creek near Pinedale, Wyo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.1	1.2	2.2	2.4	2.1	2.0	1.0
2	1.1	1.2	2.2	2.4	2.15	1.9	1.0
3	1.1	1.2	2.1	2.5	2.0	1.9	1.0
4	1.1	1.2	2.0	2.6	2.0	1.8	1.0
5	1.1	1.2	2.0	2.65	2.0	1.8	1.0
6	1.1	1.25	2.0	2.7	2.0	1.8	1.0
7	1.1	1.25	2.0	2.7	2.0	1.7	1.0
8	1.1	1.25	2.0	2.75	1.9	1.7	1.0
9	1.1	1.25	2.0	2.75	1.9	1.7	1.0
10	1.1	1.25	2.0	2.8	1.8	1.7	1.0
11	1.1	1.35	2.0	2.8	1.75	1.65	1.05
12	1.05	1.4	2.2	2.8	1.7	1.6	1.1
13	1.1	1.5	2.3	2.8	1.7	1.2	1.1
14	1.1	1.55	2.6	2.9	1.65	1.1	1.1
15	1.05	1.6	2.75	2.85	1.7	1.1	1.1
16	1.05	1.7	2.9	2.8	1.7	1.05	1.1
17	1.05	1.7	3.0	2.75	1.7	1.05	1.0
18	1.1	1.7	3.0	2.7	1.7	1.05	1.0
19	1.1	1.7	3.0	2.65	1.65	1.0	1.0
20	1.1	1.7	2.9	2.6	1.65	1.0	1.0
21	1.1	1.8	2.8	2.5	1.7	1.0	1.0
22	1.1	1.8	2.75	2.5	1.95	1.0	1.0
23	1.1	1.8	2.7	2.5	2.15	1.0	1.0
24	1.1	1.9	2.7	2.5	2.25	1.0	1.0
25	1.1	2.0	2.55	2.5	2.25	1.0	1.0
26	1.1	2.1	2.5	2.4	2.25	1.0	1.0
27	1.1	2.1	2.45	2.3	2.25	1.0	1.0
28	1.1	2.2	2.45	2.3	2.2	1.0	1.0
29	1.1	2.3	2.45	2.2	2.2	1.0	1.0
30	1.1	2.3	2.4	2.2	2.15	1.1	1.0
31	.....	2.25	.....	2.15	2.1	.....	1.0

Rating table for Pine Creek near Pinedale, Wyo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	18	1.50	145	2.00	378	2.50	770	3.00	1,320
1.10	34	1.60	182	2.10	443	2.60	870		
1.20	55	1.70	223	2.20	515	2.70	970		
1.30	81	1.80	269	2.30	594	2.80	1,080		
1.40	111	1.90	320	2.40	679	2.90	1,200		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1906 and is well defined above gage height 1.2 feet.

Monthly discharge of Pine Creek near Pinedale, Wyo., for 1906.

[Drainage area, 130 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	34	26	32.9	1,960	0.253	0.28
May	594	55	228	14,000	1.75	2.02
June	1,320	378	745	44,300	5.73	6.39
July	1,200	479	859	52,800	6.61	7.62
August	554	202	359	22,100	2.76	3.18
September	378	18	118	7,020	.908	1.01
October	34	18	20.8	1,280	.160	.18
The period				143,000		

NOTE.—Values are rated as follows: April and October, fair; May and September, good; June to August, excellent.

POLE CREEK AT FAYETTE, WYO.

This station was established April 22, 1904. It is located at a point opposite and about 300 yards distant from Fayette post-office, in sec. 9, T. 33 N., R. 108 W. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 25, where are given also references to publications that contain data for previous years.

Discharge measurements of Pole Creek at Fayette, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 30	A. J. Parshall	[a] 42	[a] 44	1.50	75
May 2	do	[a] 45	[a] 48	1.60	86
May 26	do	70	117	2.75	529
May 28	do	71	120	2.80	556
June 15	G. N. Stadin	72	181	3.30	996
June 18	do	72	163	3.15	826
June 29	A. J. Parshall	70	89	2.32	302
July 2	do	70	96	2.40	338

[a] Wading section.

Daily gage height, in feet, of Pole Creek at Fayette, Wyo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.5	1.55	2.45	2.35	1.9	2.1	1.3
2	1.5	1.6	2.35	2.35	1.9	2.1	1.3
3	1.5	1.65	2.25	2.35	1.85	2.0	1.3
4	1.5	1.7	2.2	2.35	1.85	2.0	1.3
5	1.5	1.7	2.2	2.55	1.85	1.95	1.3
6	1.5	1.7	2.25	2.65	1.8	1.9	1.3
7	1.5	1.75	2.25	2.65	1.75	1.9	1.3
8	1.5	1.8	2.3	2.65	1.75	1.9	1.3
9	1.5	1.85	2.2	2.65	1.75	2.0	1.3
10	1.5	1.9	2.2	2.65	1.6	2.2	1.3
11	1.5	2.05	2.25	2.6	1.65	2.2	1.2
12	1.1	2.15	2.8	2.55	1.65	2.9	1.2
13	1.1	2.35	3.3	2.55	1.65	2.85	1.2
14	1.1	2.5	3.3	2.55	1.65	2.8	1.2
15	1.1	2.55	3.3	2.5	1.6	2.8	1.25

Daily gage height, in feet, of Pole Creek at Fayette, Wyo., for 1906—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
16	1.1	2.5	3.25	2.5	1.6	2.75	1.15
17	1.1	2.5	3.3	2.4	1.55	2.6	1.1
18	1.15	2.4	3.2	2.35	1.55	2.45	1.1
19	1.15	2.4	3.05	2.3	1.5	2.35	1.1
20	1.15	2.3	2.85	2.25	1.5	2.3	1.1
21	1.15	2.35	2.65	2.15	1.65	2.25	1.1
22	1.15	2.4	2.55	2.15	1.65	2.15	1.1
23	1.2	2.5	2.5	2.15	1.8	2.1	1.1
24	1.2	2.6	2.5	2.15	2.45	1.9	1.1
25	1.25	2.7	2.45	2.15	2.45	1.7	1.0
26	1.35	2.75	2.4	2.15	2.45	1.7	1.0
27	1.45	2.8	2,3	2.15	2.4	1.6	1.0
28	1.5	2.85	2.3	2.1	2.35	1.55	1.0
29	1.5	2.8	2.3	2.1	2.35	1.4	1.0
30	1.55	2.75	2.35	2.05	2.25	1.4	1.0
31	.....	2.65	.....	2.0	2.15	.....	1.0

Rating table for Pole Creek at Fayette, Wyo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	19	1.50	76	2.00	190	2.50	383	3.00	710
1.10	27	1.60	94	2.10	221	2.60	440	3.10	795
1.20	36	1.70	114	2.20	255	2.70	500	3.20	885
1.30	47	1.80	137	2.30	293	2.80	565	3.30	980
1.40	60	1.90	162	2.40	335	2.90	635		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905–06 and is well defined between gage heights 1.0 feet and 3.0 feet.

Monthly discharge of Pole Creek at Fayette, Wyo., for 1906.

[Drainage area, 126 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	85	27	54.0	3,210	0.429	0.48
May	600	85	313	19,200	2.48	2.86
June	980	255	476	28,300	3.78	4.22
July	470	190	328	20,200	2.60	3.00
August	359	76	168	10,300	1.33	1.53
September	635	60	264	15,700	2.10	2.34
October	47	19	32.6	2,000	.259	.30
The period				98,900		

NOTE.—Values are rated as follows: April and October, good; remainder of the period, excellent.

BOULDER CREEK NEAR BOULDER, WYO.

This station was established April 23, 1904. It is located at the Coolidge ranch, about 1½ miles northeast of Boulder post-office, in sec. 4, T. 32 N., R. 108 W., and is below all diversion ditches. In the 1904 Progress Report this station was given as Boulder Creek near Newfork, Wyo. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 30, where are given also references to publications that contain data for previous years.

Discharge measurements of Boulder Creek near Boulder, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 1	A. J. Parshall	[a] 60	[a] 98	0.80	101
May 1	do	52	114	.80	100
May 26	do	81	265	2.90	1,040
May 28	do	80	256	[b] 2.70	883
June 15	G. N. Stadin	83	439	5.00	2,540
June 18	do	83	356	3.90	1,500
June 29	A. J. Parshall	77	240	2.25	684
July 1	do	77	242	2.25	683

[a] Wading section.
[b] A large tree lodged near gage probably raised the water surface slightly.

Daily gage height, in feet, of Boulder Creek near Boulder, Wyo., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	0.80	1.85	2.30	1.10	1.00	0.50	17	2.10	4.30	2.00	0.70	0.55	0.40
2	0.80	1.70	2.32	1.05	0.98	0.50	18	1.78	3.85	1.92	0.70	0.60	0.40
3	0.80	1.70	2.62	1.00	0.92	0.50	19	1.70	3.32	1.88	0.70	0.62	0.40
4	0.80	1.75	2.75	1.00	0.85	0.45	20	1.75	2.95	1.75	0.70	0.58	0.40
5	0.80	2.08	2.80	1.00	0.80	0.45	21	2.00	2.70	1.68	0.70	0.60	0.40
6	0.80	2.40	2.75	1.00	0.80	0.40	22	2.28	2.88	1.60	0.85	0.52	0.40
7	0.85	2.35	2.60	0.98	0.80	0.40	23	2.55	2.85	1.60	1.10	0.40	0.40
8	1.00	2.20	2.60	0.92	0.75	0.40	24	2.82	2.70	1.60	1.25	0.40	0.40
9	1.12	2.10	2.52	0.82	0.70	0.40	25	2.90	2.30	1.60	1.45	0.45	0.40
10	1.28	2.22	2.50	0.80	0.70	0.40	26	2.90	1.98	1.60	1.50	0.50	0.35
11	1.65	2.70	2.50	0.80	0.70	0.40	27	2.88	2.00	1.60	1.45	0.50	0.35
12	2.02	3.50	2.48	0.75	0.70	0.40	28	2.70	2.15	1.60	1.35	0.50	0.30
13	2.35	4.72	2.50	0.75	0.60	0.40	29	2.68	2.30	1.35	1.30	0.50	0.30
14	2.35	5.10	2.50	0.70	0.55	0.40	30	2.50	2.30	1.22	1.12	0.50	0.30
15	2.35	4.85	2.45	0.70	0.50	0.40	31	2.05	.....	1.15	1.00	.....	0.30
16	2.30	4.50	2.25	0.70	0.50	0.40							

Rating table for Boulder Creek near Boulder, Wyo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.30	18	1.10	189	1.90	515	2.70	915	3.80	1,615
0.40	29	1.20	224	2.00	560	2.80	970	4.00	1,760
0.50	42	1.30	263	2.10	605	2.90	1,030	4.20	1,910
0.60	58	1.40	304	2.20	655	3.00	1,090	4.40	2,060
0.70	77	1.50	345	2.30	705	3.20	1,210	4.60	2,220
0.80	100	1.60	387	2.40	755	3.40	1,340	4.80	2,380
0.90	127	1.70	429	2.50	805	3.60	1,475	5.00	2,540
1.00	157	1.80	472	2.60	860				

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6 and is well defined.

Monthly discharge of Boulder Creek near Boulder, Wyo., for 1906.

[Drainage area, 155 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
May	1,030	100	532	32,700	3.43	3.95
June	2,620	429	1,040	61,900	6.71	7.49
July	970	206	614	37,800	3.96	4.56
August	345	77	155	9,530	1.00	1.15
September	157	29	69.2	4,120	.446	.50
October	42	18	29.0	1,780	0.187	0.22
The period	.....	.....	.....	148,000	.....	.....

NOTE.—Values are rated as follows: May to August, good; September, fair; October, approximate.

EASTFORK RIVER AT NEWFORK, WYO.

This station was established April 1, 1905. It was originally located at a point about one-third mile southeast of Newfork post-office, in sec. 34, T. 32 N., R. 108 W. The conditions at this station are described in Water-Supply Paper No. 175, p. 32.

Owing to unsatisfactory conditions at this point the station was relocated May 1, 1906, at the county highway bridge one-fourth mile below.

There is but one channel, broken by two piers, and the banks are not liable to overflow. The bed of the stream is somewhat shifting. The channel is straight for 200 feet above and 100 feet below the station. The water is only sluggish at low stages. The river freezes solid during the winter.

Discharge measurements are made from the bridge. The initial point for soundings is at the gage on the left abutment.

The gage, which is read daily by Oliver N. Vible, is spiked to the left bridge abutment. The bench mark is a spike driven into the timber abutment of the bridge opposite the 6.50 feet mark on the gage.

Discharge measurements of Eastfork River at Newfork, Wyo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 1	A. J. Parshall	70	75	1.40	110
May 26	do	75	349	4.25	1,580
May 28	do	75	292	3.55	1,010
June 15	G. N. Stadin	75	382	4.75	1,740
June 18	do	75	298	3.60	1,050
June 29	A. J. Parshall	75	195	2.65	512
July 1	do	75	183	2.50	463

Daily gage height, in feet, of Eastfork River at Newfork, Wyo., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.40	2.50	2.30	1.45	1.30	1.10	17	2.60	4.28	2.00	1.10	1.15	1.00
2	1.40	2.40	2.60	1.40	1.20	1.10	18	2.50	3.55	1.95	1.15	1.10	1.00
3	1.35	2.60	2.75	1.45	1.20	1.10	19	2.60	3.05	1.90	1.10	1.10	1.00
4	1.45	3.00	2.80	1.50	1.20	1.10	20	3.00	2.85	1.80	1.10	1.10	1.00
5	1.60	3.60	2.65	1.40	1.20	1.10	21	3.65	2.80	1.70	1.60	1.10	1.00
6	1.65	3.95	2.50	1.40	1.15	1.10	22	3.80	2.85	1.75	2.00	1.10	1.00
7	1.70	3.30	2.80	1.35	1.10	1.10	23	4.15	2.75	1.55	2.10	1.10	1.00
8	1.80	2.60	2.75	1.30	1.10	1.10	24	4.10	2.50	1.55	2.00	1.10	1.00
9	2.10	2.60	2.50	1.25	1.00	1.00	25	4.15	2.15	1.60	1.85	1.10	1.00
10	2.70	3.20	2.40	1.25	1.10	1.00	26	4.25	2.12	1.65	1.75	1.10	1.00
11	3.40	4.25	2.35	1.20	1.10	1.00	27	3.65	2.18	1.60	1.60	1.10	1.00
12	3.80	4.70	2.30	1.25	1.00	1.00	28	3.55	2.40	1.55	1.50	1.10	1.00
13	3.50	5.18	2.40	1.25	1.10	1.00	29	3.80	2.55	1.50	1.40	1.10	1.00
14	3.20	5.38	2.45	1.20	1.10	1.00	30	3.10	2.32	1.40	1.35	1.10	1.00
15	3.25	4.72	2.30	1.15	1.10	1.00	31	2.70	.....	1.50	1.35	.....	1.00
16	3.00	4.25	2.10	1.15	1.10	1.00							

Rating table for Eastfork River at Newfork, Wyo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	47	1.80	205	2.60	500	3.40	925	4.40	1,590
1.10	59	1.90	234	2.70	550	3.50	985	4.60	1,740
1.20	73	2.00	265	2.80	600	3.60	1,045	4.80	1,900
1.30	90	2.10	299	2.90	650	3.70	1,110	5.00	2,060
1.40	109	2.20	335	3.00	700	3.80	1,175	5.20	2,230
1.50	130	2.30	373	3.10	755	3.90	1,240	5.40	2,400
1.60	153	2.40	413	3.20	810	4.00	1,305		
1.70	178	2.50	455	3.30	865	4.20	1,445		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 7 discharge measurements made during 1906, and is well defined between gage heights 1.4 feet and 5 feet.

Monthly discharge of Eastfork River at Newfork, Wyo., for 1906.

[Drainage area, 320 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
May	1,480	100	713	43,800	2.23	2.57
June	2,380	306	887	52,800	2.77	3.09
July	600	109	321	19,700	1.00	1.15
August	299	59	120	7,380	.375	.43
September	90	47	61.6	3,670	.193	.22
October	59	47	50.1	3,080	.157	.18
The period				130,000		

NOTE.—Values are rated as follows: May to July, excellent; August, good; September and October, fair.

YAMPA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Yampa River rises in Egeria Park, in the southeastern part of Routt County, Colo., runs in a generally northerly direction to Steamboat Springs, and thence westward to its point of junction with Green River, just east of the Colorado-Utah State boundary. Throughout almost its entire course it flows in a succession of open valleys alternating with deep, narrow canyons, the longest and deepest of the canyons being that through which it enters the Green.

The drainage basin of the river lies for the most part within the boundaries of Routt County, which is a little larger than the State of Massachusetts and comprises about 6,000 square miles. Its eastern limit is formed by the Park Mountains, and the melting of the snows on their high peaks is the source of numerous small streams whose waters augment the volume of the river and form its chief perennial supply. Westward from the mountains the basin is largely the eroded and dissected Yampa Plateau, whose wide terraces, abrupt cliffs, and deep-cut gulches and arroyos are the striking features of the region. The general level is over 6,000 feet above sea.

Elk River, Fortification Creek, Elk Head Creek, Williams River, and Little Snake River are the most important tributaries of the

Yampa. The upper basins of these streams are within the forested region, but along their lower courses are many cultivated areas.

YAMPA RIVER AT STEAMBOAT SPRINGS, COLO.

This station was established May 3, 1904, at the highway bridge at the east end of Steamboat Springs. May 8, 1905, it was reestablished at the new steel highway bridge, about one-fourth mile below the old bridge, in sec. 17, T. 6 N., R. 84 W. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 35, where are given also references to publications that contain data for previous years.

Discharge measurements of Yampa River at Steamboat Springs, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 29	A. A. Weiland	95	231	5.75	914
May 13	do	97	332	6.70	1,880
May 26	do	97	389	7.45	2,760
June 11	do	97	402	7.45	2,930
June 29	do	97	253	5.88	1,150
July 12	do	93	161	5.11	472
July 30	do	90	88	4.32	138
August 16	do	90	79	4.20	120
August 23	do	90	100	4.40	159

Daily gage height, in feet, of Yampa River at Steamboat Springs, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	4.68	5.68	7.15	5.60	4.45	4.25	4.38
2	4.78	5.52	7.28	5.55	4.45	4.35	4.38
3	4.75	5.62	7.35	5.38	4.45	4.48	4.38
4	4.65	5.85	7.40	5.10	4.38	4.38	4.38
5	4.65	6.38	7.65	5.10	4.40	4.28	4.38
6	4.78	6.38	7.98	5.10	4.42	4.28	4.38
7	4.92	6.05	7.10	5.55	4.42	4.28	4.38
8	5.00	6.35	6.65	5.38	4.42	4.28	4.38
9	5.00	6.65	7.08	5.25	4.38	4.28	4.38
10	5.28	6.80	7.62	5.25	4.30	4.28	4.38
11	5.50	6.88	8.05	5.20	4.28	4.28	4.38
12	5.50	6.88	8.45	5.20	4.22	4.28	4.38
13	5.15	6.90	8.60	5.12	4.30	4.28	4.38
14	4.95	6.65	8.48	5.08	4.70	4.30	4.38
15	5.20	6.65	8.30	5.08	4.50	4.40	4.35
16	5.42	6.85	8.10	4.95	4.45	4.52	4.32
17	5.75	7.05	7.45	4.80	4.40	4.60	4.32
18	5.80	7.05	7.32	4.75	4.40	4.60	4.32
19	5.80	7.30	7.15	4.72	4.40	4.60	4.32
20	5.92	7.45	6.75	4.65	4.42	4.60	4.32
21	6.15	7.55	6.72	4.60	4.42	4.60	4.32
22	6.50	7.70	6.78	4.58	4.42	4.55	4.32
23	6.45	7.65	6.48	4.50	4.42	4.45	4.32
24	6.82	7.55	6.15	4.50	4.42	4.40	4.32
25	6.25	7.70	6.05	4.50	4.42	4.40	4.38
26	6.10	7.48	6.05	4.50	4.32	4.38	4.40
27	6.05	7.32	6.02	4.45	4.28	4.38	4.42
28	5.98	7.78	5.75	4.38	4.28	4.38	4.38
29	5.75	8.25	5.80	4.38	4.25	4.38	4.38
30	5.78	7.50	5.72	4.35	4.25	4.38	4.38
31	.....	7.10	.....	4.30	4.25	.....	4.38

Rating table for Yampa River at Steamboat Springs, Colo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.20	110	5.10	475	6.00	1,140	6.90	2,130	7.80	3,350
4.30	140	5.20	535	6.10	1,235	7.00	2,260	7.90	3,495
4.40	170	5.30	595	6.20	1,335	7.10	2,390	8.00	3,640
4.50	205	5.40	660	6.30	1,435	7.20	2,520	8.20	3,940
4.60	240	5.50	730	6.40	1,540	7.30	2,655	8.40	4,245
4.70	280	5.60	805	6.50	1,650	7.40	2,790	8.60	4,555
4.80	325	5.70	885	6.60	1,765	7.50	2,925		
4.90	370	5.80	965	6.70	1,885	7.60	3,065		
5.00	420	5.90	1,050	6.80	2,005	7.70	3,205		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 9 discharge measurements made during 1906 and is well defined.

Monthly discharge of Yampa River at Steamboat Springs, Colo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	2,030	260	813	48,400
May	4,020	745	2,220	136,000
June	4,560	901	2,500	149,000
July	805	140	398	24,500
August	280	116	166	10,200
September	240	125	171	10,200
October	177	146	159	9,780
The period				388,000

NOTE.—Values are rated as follows: April to July, excellent; August to October, good.

YAMPA RIVER NEAR CRAIG, COLO.

This station was established April 30, 1904. It is located on the wagon bridge 1 mile south of Craig, on the road to Meeker, Colo., in sec. 6, T. 6 N., R. 90 W., just below the mouth of Fortification Creek and about 7 miles above the mouth of Williams River. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 37, where are given also references to publications that contain data for previous years.

Discharge measurements of Yampa River near Craig, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 26	A. A. Weiland	167	1,020	5.34	3,560
May 2	do	166	895	4.77	2,550
May 10	do	190	1,240	6.90	6,260
May 27	do	191	1,440	7.20	7,130
June 13	do	191	1,460	7.55	8,150
July 10	do	166	965	4.38	2,370
July 27	do	131	672	2.94	650
August 14	do	131	615	2.50	411
August 22	do	131	602	2.40	371

Daily gage height, in feet, of Yampa River near Craig, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	3.5	4.8	6.6	4.75	2.6	2.0	2.4
2	3.3	4.7	6.6	4.8	2.7	2.0	2.3
3	3.4	4.7	6.6	4.7	2.75	2.1	2.3
4	3.15	4.85	6.75	4.55	2.65	2.2	2.3
5	3.4	5.6	6.8	4.4	2.6	2.2	2.3
6	3.3	6.0	7.35	4.15	2.6	2.1	2.3
7	3.9	5.8	7.6	4.4	2.55	2.15	2.3
8	3.5	5.9	6.3	4.5	2.55	2.05	2.3
9	3.5	6.2	5.9	4.35	2.5	2.0	2.3
10	4.05	6.7	6.25	4.25	2.55	2.0	2.3
11	4.25	7.0	6.9	4.35	2.5	2.15	2.25
12	4.3	6.95	7.3	4.25	2.4	2.0	2.2
13	4.1	6.7	7.6	4.15	2.3	2.1	2.2
14	3.65	6.4	7.95	4.05	2.3	2.05	2.2
15	3.9	6.3	7.95	4.25	2.4	2.15	2.2
16	4.05	6.5	7.6	4.1	2.45	2.25	2.2
17	4.4	6.9	7.6	3.8	2.4	2.15	2.2
18	4.55	7.0	7.1	3.6	2.35	2.1	2.2
19	4.55	7.05	6.35	3.45	2.4	2.05	2.2
20	4.55	7.25	6.25	3.3	2.35	2.35	2.2
21	4.8	7.5	5.9	3.25	2.35	2.35	2.2
22	5.1	7.6	5.9	3.15	2.4	2.4	2.2
23	5.35	7.65	5.8	3.1	2.3	2.45	2.2
24	5.6	7.55	5.45	3.0	2.35	2.55	2.2
25	5.85	7.6	5.1	3.1	2.35	2.5	2.2
26	5.3	8.0	4.9	3.0	2.25	2.45	2.2
27	5.2	7.3	4.9	2.9	2.25	2.4	2.2
28	4.9	7.2	4.9	2.8	2.15	2.45	2.25
29	4.65	7.75	4.8	2.7	2.1	2.5	2.3
30	4.75	8.35	4.65	2.65	2.1	2.5	2.3
31	.....	7.15	.....	2.6	2.05	.....	2.3

Rating table for Yampa River near Craig, Colo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	200	3.00	700	4.00	1,630	5.00	3,000	7.00	6,760
2.10	230	3.10	770	4.10	1,750	5.20	3,320	7.20	7,180
2.20	265	3.20	845	4.20	1,870	5.40	3,660	7.40	7,600
2.30	305	3.30	925	4.30	2,000	5.60	4,010	7.60	8,030
2.40	350	3.40	1,010	4.40	2,130	5.80	4,370	7.80	8,470
2.50	400	3.50	1,100	4.50	2,270	6.00	4,750	8.00	8,910
2.60	450	3.60	1,195	4.60	2,410	6.20	5,140	8.20	9,350
2.70	505	3.70	1,295	4.70	2,550	6.40	5,540	8.40	9,790
2.80	565	3.80	1,400	4.80	2,700	6.60	5,940		
2.90	630	3.90	1,510	4.90	2,850	6.80	6,340		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 9 discharge measurements made during 1906 and is well defined between gage heights 2.4 feet and 8 feet.

Monthly discharge of Yampa River near Craig, Colo., for 1906.

[Drainage area, 1,730 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	4,460	808	2,100	125,000	1.21	1.35
May	9,680	2,550	6,180	380,000	3.57	4.12
June	8,800	2,480	5,620	334,000	3.25	3.63
July	2,700	450	1,470	90,400	.850	.98
August	535	215	359	22,100	.208	.24
September	425	200	283	16,800	.164	.18
October	350	265	285	17,500	.165	.19
The period	.....	.....	.....	986,000	.....	.....

NOTE.—The above values are good.

ELK RIVER NEAR TRULL, COLO.

This station was established May 2, 1904, and discontinued August 16, 1906. It is located about 2 miles southeast of Trull post-office, on the stage road between Steamboat Springs and Hayden, Colo., in sec. 32, T. 7 N., R. 85 W., and is below all tributaries. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 41, where are given also references to publications that contain data for previous years.

Discharge measurements of Elk River near Trull, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 28	A. A. Weiland	115	226	6.93	713
May 12	do	115	461	8.80	2,680
May 25	do	115	539	9.50	3,580
June 11	do	115	494	9.10	3,070
June 29	do	115	331	7.71	1,470
July 12	do	115	319	7.61	1,340
July 29	do	100	140	6.13	351
August 15	do	115	112	5.80	223
August 23	do	95	91	5.60	179

Daily gage height, in feet, of Elk River near Trull, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Day.	Apr.	May.	June.	July.	Aug.
1		7.15	8.55	8.03	6.15	17		9.02	9.50	7.15	
2		7.05	8.80	8.18	6.12	18		8.78	8.78	7.03	
3		7.20	8.78	7.98	6.00	19		9.00	8.65	6.93	
4		7.70	8.65	7.88	5.95	20		9.30	8.55	6.75	
5		8.32	8.98	7.68	5.95	21		9.25	8.45	6.75	
6		8.28	9.68	7.53	5.90	22		9.42	8.55	6.63	
7		8.30	8.78	8.00	5.85	23		9.22	8.50	6.55	
8		8.40	8.25	7.76	5.80	24		9.28	8.22	6.63	
9		8.60	8.28	7.58	5.75	25		9.60	7.75	6.43	
10		8.82	8.78	7.70	5.70	26		9.05	7.75	6.33	
11		8.90	9.15	7.53	5.65	27		9.05	8.08	6.23	
12		8.92	9.42	7.66	5.60	28	6.90	9.22	8.08	6.20	
13		8.58	9.65	7.46	5.62	29	7.18	9.98	7.82	6.05	
14		8.55	9.58	7.53	5.75	30	7.32	9.05	7.98	6.15	
15		8.52	9.42	7.40	5.78	31		8.68		6.00	
16		8.82	9.52	7.30	5.62						

Rating table for Elk River near Trull, Colo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.60	175	6.40	470	7.20	980	8.00	1,750	8.80	2,690
5.70	200	6.50	525	7.30	1,060	8.10	1,860	8.90	2,820
5.80	230	6.60	580	7.40	1,145	8.20	1,970	9.00	2,950
5.90	260	6.70	640	7.50	1,235	8.30	2,080	9.20	3,210
6.00	295	6.80	700	7.60	1,330	8.40	2,200	9.40	3,470
6.10	335	6.90	765	7.70	1,430	8.50	2,320	9.60	3,750
6.20	375	7.00	835	7.80	1,535	8.60	2,440	9.80	4,030
6.30	420	7.10	905	7.90	1,640	8.70	2,560	10.00	4,310

NOTE.—The above table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1906 and is well defined.

Monthly discharge of Elk River near Trull, Colo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May	4,280	870	2,630	162,000
June	3,860	1,480	2,590	154,000
July	1,950	295	1,010	62,100
August 1-16	355	175	241	7,650
The period				386,000

NOTE.—The above values are excellent.

ELK HEAD CREEK NEAR CRAIG, COLO.

This station was established April 27, 1906, and was discontinued September 7, 1906. It is located at Harrison's ranch, 5¾ miles east of Craig, on the road to Hayden, and about 1 mile above the junction with the Yampa.

The channel curves both above and below the station. Above the bridge, the creek will overflow the flat bottom land on both banks; below the bridge the banks are high and not liable to overflow. The bed of the stream is of sand and mud and liable to shift. There is one channel at all stages.

Measurements are made from the lower side of a single-span iron highway bridge. The initial point for soundings is the inside face of the south abutment.

A chain gage is fastened to the downstream guard rail; length of chain, 16.10 feet. The gage was read by Margaret Harrison. The bench mark is a chiseled cross on the top of the northwest corner of the south abutment of the bridge; elevation, 13.25 feet above the datum of the gage.

Discharge measurements of Elk Head Creek near Craig, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 27	A. A. Weiland	40	116	6.44	301
May 1	do	40	108	6.30	268
May 11	do	64	325	9.90	1,050
May 27	do	63	242	8.72	803
June 10	do	40	118	6.60	366
June 29	do	27	40	4.40	29
July 11	do	28	42	4.45	31
July 31	do	25	32	4.03	4.8
August 14	do	25	35	3.90	3.5
August 22	do	25	31	3.70	2.9

Daily gage height, in feet, of Elk Head Creek near Craig, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Day.	Apr.	May.	June.	July.	Aug.	Sept.
1	.....	6.28	7.78	4.42	3.90	3.65	17	.....	9.88	5.80	4.25	3.75	.....
2	.....	6.24	7.74	4.32	3.90	3.65	18	.....	9.38	5.65	4.22	3.72	.....
3	.....	6.22	7.50	4.30	3.90	3.68	19	.....	9.70	5.48	4.20	3.65	.....
4	.....	7.02	7.41	4.30	3.92	3.65	20	.....	9.98	5.30	4.15	3.65	.....
5	.....	8.45	7.34	4.19	3.92	3.65	21	.....	9.84	5.09	4.14	3.65	.....
6	.....	8.70	7.95	4.14	3.88	3.65	22	.....	9.78	4.92	4.15	3.65	.....
7	.....	8.06	7.35	4.12	3.75	3.64	23	.....	9.32	4.88	4.10	3.65	.....
8	.....	8.60	6.74	4.42	3.75	.....	24	.....	8.96	4.84	4.15	3.64	.....
9	.....	9.45	6.52	4.32	3.75	.....	25	.....	9.48	4.84	4.18	3.60	.....
10	.....	9.72	6.48	4.24	3.72	.....	26	.....	9.85	4.68	4.14	3.62	.....
11	.....	9.95	6.50	4.25	3.70	.....	27	6.35	8.80	4.54	4.15	3.62	.....
12	.....	9.75	6.48	4.25	3.70	.....	28	6.48	9.00	4.41	4.00	3.65	.....
13	.....	8.62	6.40	4.30	3.70	.....	29	6.25	9.68	4.40	3.98	3.65	.....
14	.....	8.56	6.25	4.25	3.70	.....	30	6.32	9.78	4.46	4.05	3.65	.....
15	.....	8.91	6.02	4.25	3.75	.....	31	.....	8.35	.....	.....	3.65	.....
16	.....	9.65	5.84	4.25	3.78	.....							

Rating table for Elk Head Creek near Craig, Colo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.60	2.6	4.50	36	5.40	138	6.30	282	7.40	509
3.70	2.9	4.60	45	5.50	151	6.40	301	7.60	552
3.80	3.2	4.70	55	5.60	165	6.50	321	7.80	596
3.90	3.5	4.80	65	5.70	180	6.60	341	8.00	640
4.00	4	4.90	76	5.80	195	6.70	362	9.00	860
4.10	7	5.00	88	5.90	211	6.80	383	10.00	1,080
4.20	12	5.10	100	6.00	228	6.90	404		
4.30	19	5.20	112	6.10	245	7.00	425		
4.40	27	5.30	125	6.20	263	7.20	467		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 10 discharge measurements made during 1906 and is well defined.

Monthly discharge of Elk Head Creek near Craig, Colo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May	1,080	267	840	51,600
June	629	27	257	15,300
July	29	4	13.5	830
August	3.6	2.6	3.0	184
September 1-7	2.8	2.7	2.8	38.9
The period	.....	.....	.....	68,000

NOTE.—Values are rated as follows: May and June, good; remainder of the period, approximate.

FORTIFICATION CREEK AT CRAIG, COLO.

This station was established June 12, 1905, and was discontinued June 30, 1906. It is located at the highway bridge about one-fourth mile east of Craig, Colo., in sec. 6, T. 6 N., R. 90 W.

On May 2, 1906, a new chain gage was installed at the same datum as the staff gage; length of chain, 16.60 feet. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 43.

Discharge measurements of Fortification Creek at Craig, Colo., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 12	H. G. Graham	51	84	4.40	212
1906.					
May 2	A. A. Weiland	45	63	3.90	118
May 10	do	50	142	6.00	337
May 27	do	50	117	5.50	301
June 9	do	45	56	3.84	128
June 30	W. H. Rose	3	.....	1.90	(a)

a Practically no flow.

Daily gage height and discharge of Fortification Creek at Craig, Colo., for 1905–6.

Day.	1905. June.		1906. May.		1906. June.		Day.	1905. June.		1906. May.		1906. June.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.		Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
	Feet.	*Sec.-feet.*	*Feet.*	*Sec.-feet.*	*Feet.*	*Sec.-feet.*		*Feet.*	*Sec.-feet.*	*Feet.*	*Sec.-feet.*	*Feet.*	*Sec.-feet.*
1	5.55	338	.....	.....	4.85	230	17	3.50	125	5.40	268	3.60	108
2	5.92	380	4.10	137	4.75	218	18	3.35	109	5.35	263	3.50	100
3	5.88	375	3.80	110	4.65	208	19	3.20	97	5.35	263	3.20	75
4	6.20	413	3.65	97	5.15	261	20	2.95	77	5.90	325	2.90	52
5	6.40	435	4.90	216	5.25	272	21	2.85	67	5.75	308	2.80	45
6	6.10	400	4.80	205	5.25	272	22	2.75	60	5.80	313	2.65	38
7	5.10	288	4.65	190	4.75	218	23	2.70	50	5.95	332	2.55	25
8	5.05	282	4.75	200	4.15	158	24	2.70	50	5.10	237	2.45	19
9	5.05	282	5.45	275	3.85	130	25	.....	0	5.45	275	2.40	16
10	5.45	327	5.90	325	3.95	138	26	.....	0	6.25	365	2.20	7
11	4.70	245	5.95	332	4.10	153	27	.....	0	5.45	295	2.10	3
12	4.60	233	5.55	285	4.20	163	28	.....	0	5.20	267	2.00	1
13	4.15	187	5.05	232	4.40	183	29	.....	0	6.60	427	2.00	1
14	3.95	167	4.75	200	4.05	148	30	.....	0	6.55	421	1.90	0
15	3.75	147	5.10	237	3.95	138	31	.....	.....	5.55	306	.....	.....
16	3.70	143	5.60	293	3.70	116							

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Fortification Creek at Craig, Colo., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
June	435	40	176	10,500
1906.				
May 2–31	427	97	267	15,900
June	272	0	117	6,960

NOTE.—The above values are fair.

WILLIAMS RIVER AT HAMILTON, COLO.

This station was established April 29, 1904. It is located at the highway bridge at Hamilton, on the stage road from Meeker to Craig, Colo., about 17 miles from Craig, in sec. 20, T. 5 N., R. 91 W. The conditions at this station and the bench marks are described in

Water-Supply Paper No. 175, page 44, where are given also references to publications that contain data for previous years.

Discharge measurements of Williams River at Hamilton, Colo., by A. A. Weiland, in 1906.

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
	Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 25	50	145	4.22	501	June 9	60	225	5.62	2,000
April 25	50	154	4.18	458	June 28	58	183	4.60	616
May 2	40	110	3.68	220	July 10	45	121	3.85	297
May 9	55	191	5.22	1,010	July 26	40	84	3.13	98
May 10	60	247	6.10	1,370	August 13	40	82	3.05	88
May 23	60	301	6.80	1,740	August 21	40	84	3.10	91
May 28	60	349	7.18	2,090					

Daily gage height, in feet, of Williams River at Hamilton, Colo., for 1906.

Day.	April.	May.	June.	July.	Aug.	Sept.	Oct.
1	3.60	3.72	5.68	4.27	2.97	2.90	2.95
2	3.32	3.72	5.88	4.20	3.15	3.10	2.90
3	3.10	3.80	5.75	4.10	3.00	3.10	2.87
4	3.12	4.20	5.72	4.00	3.07	3.10	2.95
5	3.22	5.08	6.05	3.93	3.05	2.93	2.93
6	3.20	4.92	6.92	3.85	3.05	2.93	2.93
7	3.30	4.82	5.90	4.07	3.05	2.90	2.90
8	3.18	5.10	5.35	3.95	3.03	2.77	2.90
9	3.18	5.45	5.50	3.87	2.95	2.75	2.90
10	3.25	5.90	6.08	3.80	2.95	2.80	2.85
11	3.45	6.22	6.25	3.80	2.87	2.75	2.85
12	3.40	6.22	6.48	3.70	2.85	2.73	2.80
13	3.08	5.55	6.70	3.83	2.95	2.70	2.75
14	3.15	5.25	6.62	3.83	3.25	2.80	2.75
15	3.15	5.42	6.35	3.83	3.20	3.10	2.70
16	3.30	6.32	6.30	3.65	3.05	3.40	2.70
17	3.50	6.75	6.25	3.55	3.07	3.20	2.65
18	3.55	6.65	5.65	3.45	3.27	3.05	2.63
19	3.48	6.95	5.42	3.40	3.10	3.05	2.70
20	3.55	7.38	5.25	3.35	3.05	3.05	2.90
21	3.75	7.25	5.05	3.30	3.07	3.05	2.90
22	3.92	7.35	5.12	3.25	2.97	3.07	2.95
23	4.25	7.22	5.05	3.20	2.95	3.00	2.93
24	4.62	6.42	4.65	3.15	2.95	2.93	2.80
25	4.32	6.40	4.55	3.07	2.93	2.90	3.00
26	4.00	6.38	4.55	3.10	2.95	3.00	2.97
27	3.80	6.32	4.55	3.10	3.00	3.20	2.97
28	3.80	7.15	4.45	3.03	2.90	3.07	2.88
29	3.82	8.12	4.38	3.05	2.85	3.03	2.77
30	3.82	6.40	4.35	3.10	2.93	2.95	2.75
31	.....	5.80	.....	3.00	2.93	.....	2.70

Rating table for Williams River at Hamilton, Colo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.60	25	3.50	186	4.40	536	5.30	965	6.40	1,565
2.70	35	3.60	218	4.50	580	5.40	1,015	6.60	1,675
2.80	47	3.70	253	4.60	625	5.50	1,070	6.80	1,790
2.90	60	3.80	290	4.70	670	5.60	1,125	7.00	1,910
3.00	75	3.90	328	4.80	715	5.70	1,180	7.20	2,030
3.10	92	4.00	368	4.90	765	5.80	1,235	7.40	2,150
3.20	111	4.10	409	5.00	815	5.90	1,290	7.60	2,270
3.30	133	4.20	451	5.10	865	6.00	1,345	7.80	2,390
3.40	158	4.30	493	5.20	915	6.20	1,455	8.00	2,510

NOTE.—The above table is applicable only for open-channel conditions. It is based on 13 discharge measurements made during 1906 and is well defined above gage height 3 feet.

Monthly discharge of Williams River at Hamilton, Colo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	634	89	218	13,000
May	2,580	260	1,340	82,400
June	1,730	514	1,120	66,600
July	480	75	230	14,100
August	126	54	78.4	4,820
September	158	35	74.0	4,400
October	75	28	53.2	3,270
The period				189,000

NOTE.—The above values are good, except those for October, which are fair.

WHITE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

White River rises in Trappers Lake, which lies at an elevation of 9,500 feet above sea level in a small mountain basin of the White River Plateau in eastern Garfield County, Colo.; thence it flows westward to its point of junction with Green River in west-central Uinta County, Utah. Throughout its course it occupies a narrow, mountainous valley, with alternating parks and canyons, entering the longest and deepest of the canyons, in which it continues to its mouth, about 8 miles east of the Colorado-Utah State line.

The basin comprises an arid, broken, and much eroded plateau region, which topograhically is a continuation of the Grand River Mesa south of Grand River. The headwater portion covers the greater area and is called the White River Plateau; below this and to the south is the Roan, or Book Cliffs, Plateau. Fragmentary plateaus also occur along the northern side of the river.

Numerous small streams, among which are Marvine Creek and South Fork, join the White in the upper, mountainous portion of the basin. Douglas, Piceance, and Evacuation Creeks, draining the Book Cliffs Plateau, enter White River from the south. In the spring these creeks carry considerable water, derived mainly from melting snow, but in the summer they are very nearly dry.

The mean annual precipitation recorded at Meeker is 15.9 inches; farther west and at lower elevations it is undoubtedly much less.

NORTH FORK OF WHITE RIVER NEAR BUFORD, COLO.

This station was established July 28, 1903. It is located at the county bridge at Rawson's ranch, below the mouth of Marvine Creek, 7 miles from Buford, the nearest post-office, and 32 miles from Meeker, Colo. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 50, where are given also references to publications that contain data for previous years.

Discharge measurements of North Fork of White River near Buford, Colo., by A. A. Weiland, in 1906.

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
	Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 6	83	136	2.55	547	July 7	83	144	2.60	630
May 18	83	186	3.20	1,040	July 20	83	114	2.25	397
June 5	83	191	3.18	1,060	August 6	83	97	2.05	318
June 25	83	170	2.90	899	August 29	83	91	1.98	296

Daily gage height, in feet, of North Fork of White River near Buford, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.82	2.08	2.95	2.78	2.18	2.02	2.00
2	1.82	2.08	2.95	2.78	2.12	2.05	1.95
3	1.80	2.15	2.95	2.68	2.10	2.00	1.95
4	1.82	2.42	2.95	2.65	2.10	2.00	1.95
5	1.82	2.65	3.05	2.60	2.10	2.00	1.90
6	1.85	2.70	3.05	2.55	2.10	2.00	1.90
7	1.82	2.60	2.95	2.60	2.08	2.00	1.90
8	1.82	2.80	3.00	2.58	2.08	2.00	1.90
9	1.82	3.02	3.15	2.50	2.08	2.00	1.90
10	1.88	3.20	3.32	2.50	2.08	2.00	1.90
11	1.88	3.20	3.35	2.50	2.08	1.98	1.90
12	1.85	2.85	3.45	2.48	2.08	1.98	1.90
13	1.88	2.68	3.60	2.42	2.10	1.98	1.90
14	1.88	2.70	3.75	2.42	2.08	2.00	1.90
15	1.88	2.98	3.85	2.40	2.05	2.08	1.90
16	1.92	3.22	3.90	2.40	2.05	2.10	1.90
17	2.02	3.22	3.80	2.35	2.08	2.05	1.90
18	2.05	3.25	3.50	2.32	2.15	2.02	1.90
19	2.00	3.55	3.42	2.30	2.08	2.02	1.90
20	2.05	3.48	3.35	2.30	2.05	2.00	1.90
21	2.18	3.60	3.25	2.25	2.05	2.00	1.90
22	2.30	3.40	3.32	2.22	2.05	2.00	1.92
23	2.40	3.35	3.30	2.22	2.05	2.00	1.90
24	2.30	3.25	2.95	2.20	2.05	2.00	1.90
25	2.22	2.95	2.95	2.15	2.00	2.00	1.88
26	2.15	2.95	2.90	2.15	2.00	2.05	1.88
27	2.08	3.25	2.82	2.15	2.00	2.02	.88
28	2.08	3.60	2.78	2.15	2.00	2.00	1.88
29	2.10	3.35	2.75	2.12	2.00	2.00	1.88
30	2.10	3.00	2.75	2.12	2.00	2.00	1.88
31	.....	2.90	.....	2.10	2.00	.....	1.88

Rating tables for North Fork of White River near Buford, Colo.

APRIL 1 TO JUNE 16, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.80	135	2.30	390	2.80	740	3.30	1,195	3.70	1,610
1.90	180	2.40	450	2.90	825	3.40	1,295	3.80	1,720
2.00	225	2.50	515	3.00	910	3.50	1,400	3.90	1,835
2.10	275	2.60	585	3.10	1,000	3.60	1,505	4.00	1,950
2.20	330	2.70	660	3.20	1,095				

JUNE 17 TO OCT. 31, 1906.[b]

1.90	255	2.30	445	2.70	720	3.10	1,100	3.50	1,500
2.00	295	2.40	505	2.80	805	3.20	1,200	3.60	1,605
2.10	340	2.50	570	2.90	900	3.30	1,300	3.70	1,710
2.20	390	2.60	640	3.00	1,000	3.40	1,400	3.80	1,815

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–5 and 3 during 1906, and is well defined below gage height 2.4 feet.

[b] This table is applicable only for open-channel conditions. It is based on 5 discharge measurements made after June 17, 1906, and is well defined below gage height 3 feet.

Monthly discharge of North Fork of White River near Buford, Colo., for 1906.

[Drainage area, 181 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	450	135	225	13,400	1.24	1.38
May	1,500	265	927	57,000	5.12	5.90
June	1,840	762	1,130	67,200	6.24	6.96
July	788	340	507	31,200	2.80	3.23
August	380	295	325	20,000	1.80	2.08
September	340	287	300	17,900	1.66	1.85
October	295	248	257	15,800	1.42	1.64
The period				222,000		

NOTE.—Values are rated as follows: April and October, good; remainder of the period, excellent.

SOUTH FORK OF WHITE RIVER NEAR BUFORD, COLO.

This station was established July 25, 1903. It is located at the county bridge at the lower end of a section of the river known as "Stillwater," about 7 miles from Buford, the nearest post-office, and about 30 miles from Meeker, Colo., in T. 1 S., R. 91 W. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 52, where are given also references to publications that contain data for previous years.

Discharge measurements of South Fork of White River near Buford, Colo., by A. A. Weiland, in 1906.

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
	Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 7	53	97	2.95	383	July 8	53	133	3.60	643
May 19	53	141	3.75	724	July 23	53	98	2.97	286
June 7	53	192	4.50	1,310	August 8	53	76	2.70	257
June 26	53	186	4.30	1,200	August 31	53	68	2.55	222

Daily gage height, in feet, of South Fork of White River near Buford, Colo., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1		4.0	3.95	2.85	2.8	2.7	17	3.6	7.75	3.25	2.8	2.8	2.6
2		4.15	3.9	2.85	2.8	2.7	18	3.7	6.5	3.2	2.8	2.75	2.6
3		4.15	3.8	2.7	2.75	2.7	19	3.82	6.0	3.1	2.8	2.7	2.6
4		4.3	3.65	2.7	2.7	2.75	20	4.1	5.9	3.0	2.8	2.7	2.6
5		4.55	3.6	2.8	2.7	2.7	21	4.1	5.35	3.05	2.8	2.7	2.6
6		5.0	3.55	2.8	2.7	2.65	22	4.35	5.1	3.0	2.8	2.7	2.6
7	3.0	4.65	3.65	2.8	2.7	2.6	23	4.4	5.2	3.0	2.75	2.7	2.6
8	3.02	4.35	3.6	2.8	2.7	2.6	24	4.15	4.65	3.0	2.7	2.7	2.65
9	3.3	4.55	3.55	2.8	2.7	2.6	25	3.95	4.3	3.0	2.7	2.7	2.65
10	3.38	5.0	3.5	2.8	2.7	2.6	26	3.85	4.35	3.0	2.7	2.7	2.6
11	3.5	5.65	3.45	2.8	2.7	2.6	27	3.8	4.5	2.9	2.7	2.8	2.6
12	3.45	6.65	3.4	2.8	2.7	2.6	28	4.15	4.3	2.9	2.7	2.7	2.6
13	3.45	7.3	3.4	2.8	2.7	2.6	29	4.45	4.05	2.85	2.7	2.7	2.6
14	3.35	7.7	3.45	2.8	2.7	2.6	30	4.2	4.05	2.8	2.75	2.7	2.6
15	3.35	7.25	3.35	2.8	2.8	2.6	31	3.95	.....	2.8	2.8	.....	2.6
16	3.5	7.55	3.3	2.8	2.8	2.6							

Daily discharge, in second-feet, of South Fork of White River near Buford, Colo., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Day.	May.	June.	July.	Aug.	Sept.	Oct.
1	.....	960	950	270	305	270	17	650	3,740	430	305	305	235
2	.....	1,050	920	275	305	270	18	700	2,740	400	305	288	235
3	.....	1,050	800	270	288	270	19	760	2,360	360	305	270	235
4	.....	1,130	730	265	270	288	20	910	2,280	325	305	270	235
5	.....	1,340	710	280	270	270	21	910	1,880	320	305	270	235
6	.....	1,640	630	285	270	252	22	1,060	1,720	300	305	270	235
7	385	1,400	675	290	270	235	23	1,130	1,780	300	288	270	235
8	393	1,220	650	295	270	235	24	980	1,410	295	270	270	252
9	515	1,340	625	305	270	235	25	880	1,190	295	270	270	252
10	551	1,640	605	305	270	235	26	820	1,220	290	270	270	235
11	605	2,100	550	305	270	235	27	800	1,320	280	270	305	235
12	582	2,850	525	305	270	235	28	980	1,200	280	270	270	235
13	582	3,370	525	305	270	235	29	1,220	1,010	260	270	270	235
14	538	3,690	550	305	270	235	30	1,070	1,010	245	288	270	235
15	538	3,320	500	305	305	235	31	930	.....	250	305	.....	235
16	605	3,580	480	305	305	235							

NOTE.—These discharges prior to August 9 were obtained by the indirect method for shifting channels; after that date they are based on a rating table.

Monthly discharge of South Fork of White River near Buford, Colo., for 1906.

[Drainage area, 148 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec. ft. per sq. mile.	Depth in inches.
May 6-31	1,220	385	764	37,900	5.16	4.80
June	3,740	960	1,880	112,000	12.70	14.17
July	950	245	486	29,900	3.28	3.78
August	305	265	290	17,800	1.96	2.26
September	305	270	278	16,500	1.88	2.10
October	288	235	243	14,900	1.64	1.89
The period	.....	.....	.....	229,000	.....	.....

NOTE.—The above values are fair.

WHITE RIVER AT MEEKER, COLO.

This station was established May 24, 1901. It is located about one-half mile above the town of Meeker, at a point where a wagon bridge crosses the stream, on the ranch of L. F. Van Cleave, in sec. 25, T. 1 N., R. 94 W. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 54, where are given also references to publications that contain data for previous years.

Discharge measurements of White River at Meeker, Colo., by A. A. Weiland, in 1906.

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
	Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 23	79	267	4.60	980	June 23	78	310	5.47	1,990
May 4	79	240	4.39	747	July 3	78	267	4.60	1,010
May 17	78	326	5.50	3,000	July 24	78	187	4.05	651
May 22	78	380	6.15	3,260	August 10	78	167	3.85	356
May 31	78	343	5.65	2,380	August 20	78	172	3.90	369
June 8	78	336	5.55	2,250					

Daily gage height, in feet, of White River at Meeker, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	3.80	4.28	5.55	5.00	3.92	3.75	3.80
2	3.68	4.25	5.68	4.92	3.95	3.82	3.80
3	3.65	4.22	5.65	4.82	3.90	3.95	3.78
4	3.65	4.35	5.68	4.78	3.88	3.80	3.75
5	3.65	4.80	5.80	4.68	3.90	3.80	3.80
6	3.68	4.90	6.05	4.58	3.90	3.75	3.78
7	3.88	4.82	5.82	4.68	3.88	3.70	3.78
8	3.78	5.00	5.52	4.62	3.85	3.70	3.78
9	3.82	5.22	5.58	4.58	3.85	3.70	3.70
10	3.90	5.40	5.72	4.52	3.85	3.70	3.70
11	3.98	5.60	5.92	4.55	3.80	3.70	3.70
12	3.92	5.62	6.10	4.48	3.82	3.62	3.68
13	3.78	5.30	6.25	4.42	3.90	3.62	3.68
14	3.72	5.20	6.38	4.58	4.02	3.72	3.65
15	3.82	5.20	6.30	4.45	3.92	4.05	3.65
16	3.92	5.52	6.25	4.38	3.85	4.08	3.65
17	4.08	5.65	6.28	4.32	3.92	3.92	3.65
18	4.20	5.72	6.08	4.30	3.98	3.92	3.65
19	4.05	5.90	5.90	4.22	3.88	3.90	3.65
20	4.15	6.08	5.85	4.20	3.85	3.92	3.70
21	4.25	6.02	5.78	4.12	3.85	3.92	3.70
22	4.40	6.12	5.72	4.10	3.88	3.90	3.70
23	4.55	6.10	5.68	4.05	3.82	3.90	3.68
24	4.72	5.92	5.50	4.02	3.82	3.85	3.58
25	4.52	5.80	5.28	4.00	3.75	3.82	3.70
26	4.45	5.70	5.22	4.00	3.72	3.82	3.72
27	4.30	5.65	5.25	3.95	3.70	3.92	3.72
28	4.30	5.95	5.18	3.92	3.70	3.88	3.72
29	4.28	6.22	5.05	3.90	3.70	3.82	3.70
30	4.30	5.85	5.05	3.88	3.70	3.80	3.70
31	.....	5.60	.....	3.85	3.72	.....	3.70

Rating tables for White River at Meeker, Colo.

APRIL 1 TO JULY 31, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.70	435	4.30	770	4.90	1,295	5.50	2,090	6.00	2,970
3.80	485	4.40	840	5.00	1,405	5.60	2,250	6.10	3,160
3.90	535	4.50	920	5.10	1,525	5.70	2,420	6.20	3,350
4.00	590	4.60	1,000	5.20	1,655	5.80	2,600	6.30	3,550
4.10	645	4.70	1,090	5.30	1,795	5.90	2,780	6.40	3,750
4.20	705	4.80	1,190	5.40	1,940				

AUG. 9 TO OCT. 31, 1906.[b]

3.60	250	3.80	331	3.90	378	4.00	428	4.10	480
3.70	288	.....	.....	.....	.....	.....	.....	.....	.....

[a] This table is applicable only for open-channel conditions. It is based on 8 discharge measurements made during 1906 and is well defined between gage heights 4 feet and 6.4 feet.

[b] This table is applicable only for open-channel conditions. It is based on 2 discharge measurements made during 1906 and the form of the preceding curve. From August 1 to 8, discharges were obtained by a transition between the tables.

Monthly discharge of White River at Meeker, Colo., for 1906.

[Drainage area, 634 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	1,120	410	628	37,400	0.991	1.11
May	3,390	718	2,100	129,000	3.31	3.82
June	3,710	1,460	2,530	151,000	3.99	4.45
July	1,400	510	836	51,400	1.32	1.52
August	500	288	371	22,800	.585	.67
September	470	258	345	20,500	.544	.61
October	331	243	292	18,000	.461	.53
The period				430,000		

NOTE.—The above values are good.

WHITE RIVER NEAR DRAGON, UTAH.

This station was established April 17, 1906. It is located at the toll bridge of the Uinta Stage Company, 18 miles northwest of Dragon, from which it is reached by stage.

The channel is straight for 400 feet above and below the station. The right bank is of shale, and high; the left bank is of earth and overflows at high water. The bed of the stream is composed of cobblestones and sand, somewhat shifting. There is one channel at all stages, broken by pile-bents, which somewhat disturb the current. The velocity of the current becomes very great at high stages.

Discharge measurements are made from the downstream side of the bridge. The initial point for soundings is on the left bank, the hand-rail being graduated at 5-foot intervals.

A standard chain gage was installed May 14, 1906; length of chain, 22.65 feet. Prior to this date a staff gage was used having the same datum. The gages were read by J. B. Blankenship. The bench mark is a vertical standard Geological Survey iron post, set on the left bank about 75 feet downstream from the bridge; elevation, 23.85 feet above the datum of the gage.

Discharge measurements of White River near Dragon, Utah, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 17	R. I. Meeker	72	184	3.60	587
April 18	do	73	198	3.78	679
May 13	do	80	506	6.60	2,310
June 24	do	89	631	6.20	1,950
July 19	T. E. Brick	72	285	4.28	931

Daily gage height, in feet, of White River near Dragon, Utah, for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	4.00	4.85	6.75	5.12	3.50	3.85	3.50
2	3.90	4.82	6.55	5.12	3.80	3.88	3.58
3	3.80	4.65	6.60	5.00	3.75	3.95	3.55
4	3.70	4.48	6.58	4.92	3.68	4.20	3.50
5	3.60	4.48	6.42	4.80	3.65	3.85	3.52
6	3.60	4.80	6.52	4.65	3.58	3.65	3.55
7	3.60	5.35	6.78	4.65	3.50	3.55	3.60
8	3.60	5.45	6.88	5.40	3.50	3.52	3.50
9	3.60	5.55	6.30	4.68	3.50	3.50	3.45
10	3.60	5.95	6.12	4.62	3.40	3.42	3.48
11	3.60	6.38	6.38	4.52	3.32	3.40	3.45
12	3.60	6.10	6.50	4.50	3.30	3.38	3.45
13	3.60	6.70	6.68	4.50	3.40	3.35	3.40
14	3.60	6.30	7.00	4.48	4.20	3.30	3.40
15	3.60	6.00	7.20	4.62	3.75	3.70	3.40
16	3.60	5.80	7.35	4.60	3.68	5.15	3.45
17	3.60	6.02	7.38	4.42	3.90	5.20	3.40
18	3.75	6.30	7.40	4.32	3.80	4.15	3.38
19	4.30	6.45	7.52	4.30	4.65	3.95	3.35
20	4.40	6.62	7.32	4.22	4.25	3.80	3.40
21	4.05	6.70	6.60	4.15	3.65	3.72	3.40
22	4.25	7.00	6.45	4.05	3.75	3.80	3.42
23	4.55	7.05	6.32	3.98	3.60	3.75	3.45
34	4.70	7.22	6.25	3.90	3.58	3.68	3.42
25	4.95	7.90	6.10	3.85	3.48	3.65	3.42
26	4.95	7.00	5.75	3.75	3.40	3.60	3.45
27	4.90	6.75	5.58	3.70	3.38	4.10	3.48
28	4.90	6.50	5.55	3.68	3.30	3.95	3.45
29	4.70	6.92	5.45	3.75	3.35	3.80	3.40
30	4.65	7.25	5.38	3.55	3.32	3.72	3.45
31	.....	7.42	.....	3.45	3.42	.....	3.48

Rating table for White River near Dragon, Utah, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.30	505	4.10	815	4.90	1,200	5.70	1,665	7.00	2,560
3.40	540	4.20	860	5.00	1,255	5.80	1,730	7.20	2,710
3.50	575	4.30	905	5.10	1,310	5.90	1,795	7.40	2,860
3.60	610	4.40	950	5.20	1,365	6.00	1,860	7.60	3,010
3.70	650	4.50	1,000	5.30	1,420	6.20	1,990	7.80	3,170
3.80	690	4.60	1,050	5.40	1,480	6.40	2,130		
3.90	730	4.70	1,100	5.50	1,540	6.60	2,270		
4.00	770	4.80	1,150	5.60	1,600	6.80	2,410		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 5 discharge measurements made during 1906 and is fairly well defined. The high water of May caused a great change in area at the measuring section, but did not materially alter the relation of discharge to gage height.

Monthly discharge of White River near Dragon, Utah, for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	1,230	610	804	47,800
May	3,250	990	2,000	123,000
June	2,950	1,470	2,230	133,000
July	1,480	558	949	58,400
August	1,080	505	627	38,600
September	1,360	505	707	42,100
October	610	522	560	34,400
The period				477,000

NOTE.—The above values are good.

MARVINE CREEK NEAR BUFORD, COLO.

This station was established July 27, 1903. It is located at a point where the stream is crossed by a large aspen log. The station is 10 miles from Buford, the nearest post-office, and is about 35 miles from Meeker. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 58, where are given also references to publications that contain data for previous years.

Discharge measurements of Marvine Creek near Buford, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 19	A. A. Weiland	28	45	2.30	201
June 5	do	28	48	2.37	230
June 25	do	28	43	2.50	258
July 6	do	28	46	2.36	245
July 19	do	28	38	2.25	148
August 5	do	28	36	2.10	129
August 28	do	28	38	2.15	137

Daily gage height, in feet, of Marvine Creek near Buford, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1		1.95	2.32	2.40	2.18	2.20	2.18	2.10
2		1.95	2.35	2.38	2.18	2.22	2.18	2.10
3		2.00	2.35	2.32	2.18	2.25	2.18	2.10
4		2.05	2.35	2.32	2.18	2.18	2.18	2.10
5		2.10	2.38	2.32	2.18	2.18	2.18	
6		2.15	2.40	2.35	2.18	2.18	2.18	
7		2.18	2.30	2.38	2.18	2.18	2.18	
8		2.20	2.28	2.38	2.12	2.15	2.15	
9		2.22	2.32	2.32	2.12	2.15	2.15	
10		2.22	2.38	2.32	2.12	2.15	2.15	
11		2.22	2.42	2.28	2.12	2.15	2.15	
12		2.22	2.48	2.22	2.12	2.15	2.15	
13		2.20	2.52	2.15	2.12	2.15	2.15	
14		2.22	2.58	2.12	2.12	2.20	2.15	
15	1.90	2.30	2.68	2.10	2.12	2.22	2.15	
16	1.95	2.35	2.75	2.10	2.12	2.20	2.15	
17	1.95	2.35	2.70	2.10	2.18	2.20	2.15	
18	1.95	2.35	2.65	2.10	2.18	2.18	2.15	
19	1.95	2.35	2.65	2.10	2.15	2.15	2.15	
20	1.98	2.35	2.65	2.15	2.18	2.18	2.15	
21	1.98	2.38	2.55	2.22	2.18	2.18	2.12	
22	2.02	2.38	2.65	2.20	2.18	2.18	2.12	
23	2.10	2.30	2.65	2.22	2.18	2.18	2.12	
24	2.10	2.32	2.55	2.20	2.18	2.18	2.12	
25	2.02	2.28	2.50	2.18	2.18	2.18	2.12	
26	1.95	2.28	2.50	2.18	2.18	2.20	2.12	
27	1.95	2.32	2.55	2.18	2.18	2.18	2.12	
28	2.00	2.38	2.48	2.18	2.18	2.18	2.12	
29	1.98	2.35	2.45	2.18	2.18	2.18	2.10	
30	1.95	2.35	2.42	2.18	2.18	2.18	2.10	
31		2.35		2.20	2.20		2.10	

NOTE.—Gage heights for April somewhat uncertain; those for May 1 to 5 interpolated.

Rating table for Marvine Creek near Buford, Colo.

APRIL 19, 1905, TO JULY 12, 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.70	74	2.00	126	2.30	205	2.50	269	2.70	339
1.80	89	2.10	150	2.40	235	2.60	304	2.80	377
1.90	106	2.20	177						

NOTE. The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904-1906 and is well defined between gage heights 1.8 feet and 2.5 feet. From July 13 to November 4, 1906, the following table was used: Gage height, 2.10 feet; discharge, 123 second-feet. Gage height, 2.20 feet; discharge, 146 second-feet. Gage height, 2.30 feet; discharge, 170 second-feet.

Monthly discharge of Marvine Creek near Buford, Colo., for 1906.

[Drainage area, 50 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec. ft. per sq. mile.	Depth in inches.
April 15-30	150	106	123	3,900	2.46	1.46
May	229	116	191	11,700	3.82	4.40
June	358	199	268	15,900	5.36	5.98
July	235	123	167	10,300	3.34	3.85
August	146	128	137	8,420	2.74	3.16
September	158	134	141	8,390	2.82	3.15
October	141	123	133	8,180	2.66	3.07
The period				66,800		

NOTE.—Values are rated as follows: April, and August to October, fair; May to July, good.

DUCHESNE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Duchesne River rises in the high peaks of the Uinta and Wasatch mountains, flows in a general southeasterly direction, and enters Green River 3 miles above the mouth of the White. It is a very crooked stream, swinging back and forth across its valley, its course marked by a thick line of cottonwoods.

The principal tributaries of the Duchesne are Strawberry, East, and Lake creeks and Uinta River. From the mouth of Strawberry Creek down to Lake Creek the valley of the Duchesne averages 2 miles in width and is bordered on both sides by sandstone bluffs approximately 200 feet high. The cliffs on the northern side of the river are capped by a heavy deposit of coarse river gravel and cobblestones.

Strawberry Creek, the main upper tributary of the Duchesne, drains an area of 1,166 square miles. The stream rises in the Uinta Mountains and the run-off is derived chiefly from melting snow except during the late summer, when the flow comes from small springs well distributed over the entire drainage basin. Numerous tributaries enter the stream, particularly from the north and west, Indian, Bryants Fork, Mud, Horse, Sugar Spring, and Co-op creeks being the

principal ones. They are all short and fall rapidly until they reach the valley, through which they flow sluggishly in well-defined channels. The main stream traverses the valley from north to south and is very sluggish. Very little sediment is carried by the stream at any stage. The average elevation of Strawberry Valley is 7,500 feet, which is rather high for agricultural purposes but is excellently adapted to grazing. Indian Creek drains a small portion of the southern slopes of the Uinta Mountains. Its basin comprises smooth, rolling hills, fairly well timbered with pine and aspen. The normal flow is derived chiefly from springs. The greater part of the precipitation is in the form of snow, which covers the ground for six or eight months each year.

Uinta River and its principal tributary, Whiterocks River, have their sources in a series of lakes in the Uinta Mountains, fed by the snow that exists the year round in the canyons and on the high slopes. The upper drainage area of these streams is very mountainous and difficult of access. After leaving their canyons, 7 or 8 miles above the Indian agency at Whiterocks, the rivers flow southeastward, uniting in various channels between the agency and Fort Duchesne, from which point they flow in one channel, entering Duchesne River 6 miles below, near the Ouray Indian school. Pole, Farm, and Dry Gulch creeks are small tributaries of the Uinta.

DUCHESNE RIVER NEAR MYTON, UTAH.

This station, established originally October 26, 1899, was reopened April 1, 1906, in cooperation with the United States Indian Service. It was discontinued July 10, 1906. The gage was read by H. Calvert. The conditions at this station and the bench mark are described in Water-Supply Paper No. 133, page 113.

The following measurement was made May 9, 1906:

Width, 118 feet; area, 744 square feet; gage height, 7.60 feet; discharge, 2,760 second-feet.

Daily gage height, in feet, of Duchesne River near Myton, Utah, for 1906.

Day.	Apr.	May.	June.	July.	Day.	Apr.	May.	June.	July.
1	5.50	6.72	7.85	7.88	17	5.85	7.90	10.05	.....
2	5.40	6.62	7.70	8.28	18	6.02	7.80	9.65	.....
3	5.40	6.65	7.85	8.08	19	6.12	7.85	9.25	.....
4	5.40	6.82	8.05	7.98	20	6.25	8.10	9.05	.....
5	5.40	7.20	8.20	7.90	21	6.42	8.40	8.98	.....
6	5.44	7.45	8.50	7.80	22	6.56	8.70	9.00	.....
7	5.44	7.50	8.30	7.72	23	6.78	8.85	8.70	.....
8	5.42	7.52	7.95	7.68	24	6.90	8.90	8.30	.....
9	5.50	7.62	7.95	7.68	25	6.90	8.70	7.95	.....
10	5.58	7.78	8.25	7 60	26	6.85	8.50	7.95	.....
11	5.60	7.92	8.80	.....	27	6.62	8.30	7.95	.....
12	5.61	8.15	9.30	.....	28	6.52	8.45	7.90	.....
13	5.65	8.35	9.85	.....	29	6.62	8.52	7.75	.....
14	5.62	8.30	10.15	.....	30	6.80	8.30	7.65	.....
15	5.60	8.00	10.10	.....	31	.....	8.05	.....	.....
16	5.66	7.90	10.10	.....					

Rating table for Duchesne River near Myton, Utah, for 1904 and 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.40	423	6.20	1,005	7.00	1,890	7.80	3,040	9.20	5,510
5.50	484	6.30	1,100	7.10	2,020	7.90	3,205	9.40	5,890
5.60	548	6.40	1,200	7.20	2,150	8.00	3,375	9.60	6,270
5.70	615	6.50	1,305	7.30	2,290	8.20	3,715	9.80	6,650
5.80	685	6.60	1,415	7.40	2,430	8.40	4,070	10.00	7,030
5.90	760	6.70	1,530	7.50	2,575	8.60	4,430	10.20	7,410
6.00	840	6.80	1,650	7.60	2,725	8.80	4,790		
6.10	920	6.90	1,770	7.70	2,880	9.00	5,150		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 13 discharge measurements made during 1904 and 1 during 1906, and is well defined.

Monthly discharge of Duchesne River near Myton, Utah, for 1906.

[Drainage area, 2,750 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	1,770	423	893	53,100	0.325	0.36
May	4,970	1,440	3,320	204,000	1.21	1.40
June	7,320	2,800	4,520	269,000	1.64	1.83
July 1-10	3,850	2,720	3,140	62,300	1.14	.42
The period				588,000		

NOTE.—The above values are excellent.

STRAWBERRY RIVER IN STRAWBERRY VALLEY, UTAH.

This station was established May 2, 1903, and discontinued July 12, 1906. It is located in the canyon about one-fourth mile above the junction of Strawberry and Indian creeks, and is somewhat inaccessible, the nearest settlement being Heber, 40 miles away. The chief object of the station is the determination of the amount of water available for storage in Strawberry Valley. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 61, where are given also references to publications that contain data for previous years.

Discharge measurements of Strawberry River in Strawberry Valley, Utah, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 7 [a]	A. B. Larson	23	38	2.13	36.1
January 10 [b]	do	22	37	2.15	31.7
January 13 [c]	do	21	38	2.25	33.7
January 15 [d]	do	21	25	1.61	13.7
January 16 [d]	do	21	27	1.89	18.6
January 18 [e]	do	20	36	2.65	25.8
January 22 [e]	do	20	35	2.50	22.8

[a] Ice 12 to 18 inches thick.
[b] Ice 15 inches thick.
[c] Ice 18 inches thick.
[d] Water backed by snow, ice 18 inches thick.
[e] Water over top of ice.

Discharge measurements of Strawberry River in Strawberry Valley, Utah, in 1906—Cont'd.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 12	H. S. Kleinschmidt	16	15	2.65	34.4
February 18	do	16	15	2.70	30.4
March 10 [a]	do	16	14	3.25	21.0
March 21 [b]	do	16	16	3.50	19.0
April 13	H. W. Sheley	20	20	3.45	18.0
April 15	A. B. Larson	35	86	3.45	131
April 19	do	49	132	4.05	285
April 20	do	52	123	3.64	345
April 21 [c]	do	58	168	3.55	470
April 22	do	59	211	4.15	637
April 23	do	58	190	3.86	552
April 27	do	58	144	3.12	365
April 29	do	59	222	4.34	694
May 3	do	62	270	4.93	874
May 4	do	63	297	5.32	984
May 7	do	61	250	4.70	783
June 18	do	60	160	2.65	241
July 12	Thos. Grieve	60	74	1.98	106

[a] Six inches of water over ice. [b] One inch of water over ice. [c] Channel clear of ice.

Daily gage height, in feet, of Strawberry River in Strawberry Valley, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	.....	2.54	.....	3.60	3.81	3.48	2.11	17	2.50	2.68	3.20	3.32	4.13	2.80
2	.....	2.53	.....	3.50	4.02	3.48	2.05	18	2.65	2.70	3.28	3.28	4.12	2.68
3	.....	2.53	.....	3.45	4.60	3.52	.....	19	2.57	2.70	3.35	4.13	4.26	2.62
4	.....	2.55	.....	3.40	5.15	3.57	2.05	20	2.60	.....	3.40	3.53	4.51	2.58
5	.....	2.55	.....	.....	5.30	3.70	.....	21	2.49	.....	3.50	3.48	4.66	2.50
6	.....	2.55	.....	.....	4.94	3.74	2.00	22	2.50	.....	3.55	3.77	4.61	2.42
7	2.13	2.59	.....	.....	4.62	3.42	.....	23	2.53	.....	3.59	3.94	4.52	2.38
8	2.14	2.60	.....	.....	4.58	3.18	1.95	24	2.59	.....	.....	4.14	4.49	.....
9	2.07	2.62	3.22	.....	4.61	3.05	.....	25	2.60	.....	.....	4.04	4.37	2.30
10	2.15	2.63	3.25	.....	4.56	3.12	1.95	26	2.59	.....	.....	3.39	4.07	2.20
11	2.18	2.66	.....	.....	4.56	3.15	.....	27	2.56	.....	.....	3.37	4.24	.....
12	2.22	2.65	3.25	.....	4.97	3.18	1.90	28	2.57	.....	.....	3.85	4.50	.....
13	2.25	2.63	3.31	.....	5.34	3.22	.....	29	2.54	.....	.....	4.26	4.52	2.28
14	1.98	2.63	.....	2.95	4.83	3.18	.....	30	2.53	.....	.....	3.89	4.12	2.18
15	1.61	2.64	3.28	3.34	4.18	2.98	.....	31	2.53	.....	3.70	.....	3.72	.....
16	1.89	2.70	3.17	3.38	4.18	2.91	.....							

NOTE.—Ice conditions prevailed from January 1 to April 20, 1906; during this period the gage was read to water surface through a hole in the ice. The following comparative readings were made:

Comparative ice and water readings.

Date.	Water surface.	Top of ice.	Thickness of ice.	Date.	Water surface.	Top of ice.	Thickness of ice.
	Feet.	*Feet.*	*Feet.*		*Feet.*	*Feet.*	*Feet.*
January 9	2.07	2.25	1.3 to 1.7	January 17	2.5	2.5	1.5
January 12–13	.....	.....	1.5	January 21–30	(a)	.....	1.6
January 14	1.98	2.4	1.4	February 1	2.54	2.7	1.7
January 15	1.61	2.5	1.5	February 12–19	.....	.....	1.8
January 16	1.89	2.6	1.5	March 9	.....	.....	2.0

[a] Water surface 1 inch below top of ice.

From March 9 to 19, there was about 0.5 foot of water and slush on top of ice, this condition having probably existed from about February 25; on March 22 this thickness was 0.8 foot. April 17 and 18 the ice was clearing away, and formed a gorge below the gage April 19; creek clear of ice April 20.

Rating table for Strawberry River in Strawberry Valley, Utah, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.90	92	2.50	207	3.10	351	3.70	511	4.60	770
2.00	109	2.60	229	3.20	377	3.80	539	4.80	830
2.10	127	2.70	252	3.30	403	3.90	567	5.00	892
2.20	146	2.80	276	3.40	430	4.00	595	5.20	954
2.30	166	2.90	300	3.50	457	4.20	652	5.40	1,017
2.40	186	3.00	325	3.60	484	4.40	710		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 13 discharge measurements made during 1905–6, and is well defined.

Monthly discharge of Strawberry River in Strawberry Valley, Utah, for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	36	14	28.0	1,720
February	34	25	30.0	1,670
March	24	19	20.4	1,250
April	669	18	228	13,600
May	998	517	738	45,400
June	522	142	305	18,100
July 1–12	129	92	108	2,570
The period				84,300

NOTE. Values are rated as follows: January to April, good; May to July, excellent.

INDIAN CREEK IN STRAWBERRY VALLEY, UTAH.

This station was established April 5, 1905, and was discontinued July 12, 1906. It is located in the canyon about 250 feet above the junction of the creek with Strawberry Creek. It is about 1 mile below the point where Indian Creek leaves Indian Creek Valley and enters the canyon, and is 40 miles from Heber, the nearest post-office. The records will show the amount of water that can be diverted from Indian Creek into the Strawberry Valley storage reservoir. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 64.

Discharge measurements of Indian Creek in Strawberry Valley, Utah, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Thickness of ice.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Feet.*	*Sec.-ft.*
January 7	A. B. Larson	14	19	1.5-2.1	1.35	11.2
January 10	do	14	18	1.6	1.30	10.9
January 15	do	14	14	1.7	1.12	7.6
January 16	do	14	13		1.09	7.7
January 26	do	14	12	1.75	1.00	6.7
February 2	do	13	12	1.9	1.01	7.8
February 13	H. S. Kleinschmidt	12	6		1.31	12.2
February 18	do	14	7		1.30	12.4
March 12	do	14	7		1.17	8.4
April 4	H. W. Sheley	14	18		1.10	16.8
April 15	A. B. Larson	14	32	1.0-1.7	2.54	29.5
April 18	do	16	36	0.8-1.5	2.62	51.4
April 20	do	16	31		2.06	43.5
April 21	do	16	29	(a)	1.50	51.3
April 22	do	16	37		1.87	88
April 24	do	16	43		2.15	112
April 27	do	16	24		1.39	42.3
April 28	do	16	31		1.77	83
April 28	do	16	40		2.11	123
May 2	do	16	46		2.55	182
May 3	do	16	43		2.40	156
May 3	do	22	59		2.72	168
May 7	do	20	54		2.58	166
May 12	do	22	68		3.13	247
May 14	do	22	64		2.82	206
May 14	do	22	58		2.70	202
May 15	do	16	45		2.55	182
May 26	do	16	40		2.25	142
July 12	Thos. Grieve	16	17		1.30	37.7

[a] Channel clear of ice.

Daily gage height, in feet, of Indian Creek in Strawberry Valley, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1		0.95		1.45	1.73	1.90	1.35	17	1.06	1.30	0.98	3.04	2.54	1.45
2		1.01		1.30	2.10	1.90	1.35	18	1.04	1.30	.97	2.83	2.55	1.48
3		1.00		1.30	2.33	1.84		19	1.05	1.27	.97	2.47	2.54	1.48
4		1.02		1.10	[b]2.72	1.80	1.35	20	1.04	(a)	.98	1.98	2.63	1.48
5		1.05			[b]2.80	1.82		21	1.09		.98	1.42	2.66	1.42
6		1.05			[b]2.55	1.88	1.3	22	1.03		.98	1.59	2.65	1.40
7	1.35	1.10			2.50	1.72		23	1.02		1.00	1.78	2.54	1.40
8	1.34	1.15			2.55	1.60	1.30	24	1.01			1.94	2.51	
9	1.14	1.20			2.65	1.60		25	1.00			1.84	2.41	1.40
10	1.30	1.25	1.00		2.63	1.62	1.25	26	1.00			1.49	2.24	1.40
11	1.32	1.30			2.64	1.58		27	.99			1.60	2.28	
12	1.45	1.31	1.00		2.99	1.52	1.30	28	.99			1.83	2.48	
13	1.57	1.31	1.00	3.70	3.15	1.55		29	.96			2.06	2.35	1.40
14	1.08	1.31		2.48	2.77	1.52		30	.95			1.86	2.18	1.35
15	1.12	1.31		2.69	2.51	1.52		31	.95		1.57		1.95	
16	1.09	1.35	.98	2.91	2.55	1.50								

[a] Gage height fell uniformly February 20 to March 8. [b] Backwater from Strawberry River.

Comparative ice and water readings.

NOTE.—Ice conditions prevailed from January 1 to April 20, 1906; during this period the gage was read to water surface through a hole in the ice. The following comparative readings were made:

Date.	Water surface.	Top of ice.	Thickness of ice.	Date.	Water surface.	Top of ice.	Thickness of ice.
	Feet.	*Feet.*	*Feet.*		*Feet.*	*Feet.*	*Feet.*
January 8	1.34	2.4	1.5-2.0	January 16	1.09	2.5	
January 9	1.14	2.4		January 17-18	[a] 1.06	2.5	
January 10	1.30	2.4		February 1	.95	2.6	1.9
January 11	1.32	2.4		February 12-19			2.1
January 14	1.08	2.6	1.6	March 9			2.3
January 15	1.12	2.4		April 4			3.0

[a] Approximate.

Water 0.3 to 0.7 foot over top of ice April 13 to 20.

Rating table for Indian Creek in Strawberry Valley, Utah, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.3	36	1.7	72	2.1	117	2.5	167	2.9	222
1.4	44	1.8	83	2.2	129	2.6	180	3.0	236
1.5	53	1.9	94	2.3	141	2.7	194	3.1	250
1.6	62	2.0	105	2.4	154	2.8	208		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905–6 and is well defined.

Monthly discharge of Indian Creek in Strawberry Valley, Utah, for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	12	7	9.1	560
February	12	8	10.5	583
March	10	8	8.4	516
April	112	15	44.9	2,670
May	257	75	165.0	10,100
June	94	40	59.0	3,510
July (1–12)	40	32	36.8	876
The period				18,800

NOTE.—Values are rated as follows: January to April, good; May to July, excellent.

UINTA RIVER AT FORT DUCHESNE, UTAH.

This station, established originally September 14, 1899, was reopened April 21, 1906, in cooperation with the United States Indian Service. On June 13, the bridge and gage were washed away, and the station was abandoned. The gage was read during 1906 by Bert Marsing. The conditions at this station and the bench marks are described in Water-Supply Paper No. 133, page 106.

Discharge measurements of Uinta River at Fort Duchesne, Utah, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 21	R. I. Meeker	52	185	3.08	256
May 8	E. O. Greene	59	230	3.70	484

Daily gage height, in feet, of Uinta River at Fort Duchesne, for 1906.

Day.	Apr.	May.	June.	Day.	Apr.	May.	June.
1		3.05	4.45	17		4.1	
2		3.05	4.35	18		4.05	
3		3.05	4.55	19		4.25	
4		3.1	4.85	20		4.65	
5		3.25	5.45	21	3.05	5.15	
6		3.5	5.5	22	3.25	5.6	
7		3.45	5.2	23	3.4	5.75	
8		3.55	5.1	24	3.3	5.85	
9		3.75	5.45	25	3.3	5.25	
10		4.0	5.75	26	3.25	4.85	
11		4.25	6.75	27	3.15	4.6	
12		4.55	6.8	28	3.0	5.0	
13		4.75	7.0	29	3.15	4.95	
14		4.3		30	3.15	4.6	
15		4.4		31		4.45	
16		4.1					

PRICE RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Price River rises in the Wasatch Mountains, in the southeastern part of Utah County, flows in a general southeasterly direction, and unites with Green River at a point about 14 miles above Greenriver, Utah. The main source of supply is the snow in the upper reaches of the basin, where elevations range from 8,000 to 9,000 feet. The region is extremely rough and rugged. The principal rock is a loose and badly disintegrated sandstone. There is but little soil and practically no vegetation except for small groves of scrubby cedar and a few scattered pines. The original scanty underbrush and grass have been almost entirely tramped out by sheep and cattle. The river is subject to floods in the spring and early summer, during which time it carries immense quantities of sediment. Gordon and Pleasant creeks are the main tributaries. They are both short, steep streams and enter the river from the west almost at right angles.

PRICE RIVER NEAR HELPER, UTAH.

This station was established February 21, 1904. It is located on the upper side of the ford near the settlement of Spring Glen, about 3 miles south of Helper, Utah, and 350 feet west of the main line of the Denver and Rio Grande Railroad.

During 1906 a cable and car were installed, from which high-water measurements are made. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 67, where are given also references to publications that contain data for previous years.

Discharge measurements of Price River near Helper, Utah, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 19	H. S. Kleinschmidt	54	134	4.70	449
May 18	Thos. Grieve	66	216	5.70	1,220
May 31	do	64	195	5.50	870
June 30	do	59	106	4.20	187
October 18	do	42	102	3.35	30.2

Daily gage height, in feet, of Price River near Helper, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.1	3.2	3.2	4.0	4.5	5.2	4.1	4.0	3.6	3.4	3.6	3.3
2	3.1	3.2	3.3	3.8	4.4	5.2	4.1	4.5	3.6	3.4	3.5	3.3
3	3.1	3.3	3.2	3.6	4.5	5.2	4.1	4.0	3.6	3.4	3.5	3.3
4	3.1	3.3	3.2	3.8	4.6	5.2	4.0	4.0	3.5	3.4	3.4	3.3
5	3.1	3.3	3.2	3.6	5.0	5.2	4.0	4.0	3.5	3.4	3.4	3.3
6	3.1	3.3	3.3	3.6	5.2	5.1	4.0	4.0	3.5	3.4	3.4	3.3
7	3.1	3.3	3.3	4.0	5.2	5.1	4.0	3.9	3.5	3.4	3.4	3.3
8	3.2	3.3	3.3	4.0	5.2	4.0	4.0	3.9	3.4	3.4	3.4	3.3
9	3.2	3.3	3.3	4.2	5.3	4.0	4.0	3.8	3.4	3.4	3.4	3.4
10	3.2	3.3	3.4	4.2	5.4	4.9	4.0	3.8	3.4	3.4	3.4	3.3
11	3.1	3.3	3.3	4.2	5.5	4.9	3.9	3.8	3.4	3.4	3.4	3.3
12	3.1	3.3	3.3	4.2	5.8	4.9	3.9	3.8	3.4	3.4	3.4	3.3
13	3.1	3.3	3.3	4.1	5.8	4.9	3.9	3.8	3.4	3.4	3.4	3.3
14	3.1	3.3	3.3	4.1	5.6	4.9	3.9	4.2	3.4	3.4	3.4	3.3
15	3.1	3.3	3.3	4.3	5.5	4.8	3.9	3.9	3.5	3.4	3.4	3.3
16	3.1	3.3	3.2	4.4	5.5	4.8	3.9	3.9	3.6	3.4	3.4	3.3
17	3.1	3.3	3.2	4.6	5.7	4.7	3.9	3.9	3.6	3.4	3.4	3.3
18	3.1	3.3	3.2	4.7	5.7	4.6	4.7	3.8	3.6	3.4	3.4	3.3
19	3.1	3.3	3.1	4.6	5.7	4.6	5.9	3.8	3.5	3.4	3.4	3.3
20	3.1	3.4	3.3	4.6	6.0	4.5	4.0	3.8	3.5	3.4	3.3	3.3
21	3.2	3.3	3.2	4.7	6.3	4.5	3.7	3.9	3.5	3.4	3.3	3.3
22	3.2	3.3	3.3	4.7	6.3	4.4	3.7	3.9	3.5	3.4	3.3	3.3
23	3.1	3.2	3.3	4.8	6.2	4.4	3.7	3.7	3.5	3.4	3.3	3.3
24	3.1	3.2	3.6	4.9	6.2	4.3	4.8	3.7	3.5	3.4	3.3	3.4
25	3.2	3.2	3.7	4.8	5.8	4.3	3.9	3.6	3.5	3.4	3.3	3.4
26	3.2	3.2	3.7	4.7	5.6	4.3	3.9	3.6	3.5	3.4	3.3	3.4
27	3.3	3.3	3.6	4.6	5.6	4.2	3.8	3.6	3.4	3.4	3.3	3.3
28	3.3	3.3	3.8	4.5	5.6	4.2	3.8	3.6	3.4	3.4	3.3	3.3
29	3.3	.....	4.1	4.5	5.6	4.2	4.0	3.5	3.4	3.4	3.3	3.3
30	3.3	.....	4.0	4.5	5.5	4.1	4.0	3.5	3.4	3.4	3.3	3.3
31	3.2	.....	4.0	.....	5.3	.....	4.0	3.5	.....	3.4	.....	3.3

Rating table for Price River near Helper, Utah, for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.00	1	3.60	60	4.20	219	4.80	508	5.80	1,145
3.10	4	3.70	78	4.30	260	4.90	563	6.00	1,295
3.20	9	3.80	98	4.40	305	5.00	620	6.20	1,450
3.30	18	3.90	122	4.50	354	5.20	740		
3.40	30	4.00	150	4.60	404	5.40	870		
3.50	44	4.10	182	4.70	455	5.60	1,005		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906 and is well defined.

Monthly discharge of Price River near Helper, Utah, for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	18	4	7.1	437
February	30	9	16.5	916
March	182	4	38.6	2,370
April	563	60	290	17,300
May	1,530	305	949	58,400
June	740	150	446	26,500
July	1,220	78	191	11,700
August	354	44	113	6,950
September	60	30	42.0	2,510
October	30	30	30.0	1,840
November	60	18	27.5	1,640
December	30	18	19.5	1,200
The year	1,530	4	181	132,000

NOTE.—Values are rated as follows: April to June, good; July and August, fair; remainder of 1906, approximate.

GRAND RIVER DRAINAGE BASIN.

AREA AND EXTENT.

Grand River and its tributaries drain an area comprising approximately 26,180 square miles, of which 22,290 are in Colorado and the rest in eastern Utah. On the east and southeast the basin is limited by the high ranges of the Continental Divide, which separate it from the basins of Platte and the Arkansas rivers; on the north by the White River and Book Cliffs plateaus; on the west by the canyon district of the Colorado.

The tributaries include innumerable small creeks and five large streams—Blue, Eagle, Roaring Fork, Gunnison, and Dolores rivers. The main river is described first and the tributaries afterwards in their order, from the head down.

GRAND RIVER.

DESCRIPTION OF BASIN.

Grand River rises on the western slopes of the Rocky Mountains among the high peaks of the Front Range, flows in a general southwesterly direction across Colorado into Utah, and unites with Green River to form the Colorado. From source to mouth the total distance traversed is about 350 miles.

In most respects the Grand is a typical mountain stream, flowing throughout its course in a succession of deep canyons, with precipitous and ofttimes perpendicular walls varying in height up to 3,000 feet above the water's edge, alternating with long, narrow, fertile valleys.

The headwater region, comprising approximately 50 per cent of the basin, consists of a long stretch of the western portion of the

Continental Divide, extending from the north-central portion of Colorado southward nearly to the Colorado-New Mexico line, a distance of 260 miles, and separating the waters of the Grand from those of the Platte and Arkansas basins. The area is extremely rugged, elevations ranging from 7,000 to 14,000 feet. Gradients are steep, stream channels are numerous, and tributaries are rapid, the fall varying from 20 to 150 feet. The streams of this region derive their waters chiefly from the snow masses on the Continental Divide and furnish the perennial discharge of the Grand. The intermediate or middle portion of the basin, consisting largely of broken and scoured plateaus of sedimentary origin, contributes a relatively small amount of the run-off, the tributaries being few, and, with the exception of Gunnison River, insignificant. The lower portion of the basin, immediately adjacent to the Colorado-Utah State line, is an arid, much eroded region, furnishing an appreciable run-off, which carries a large amount of sediment.

The largest tributaries of the headwater region are Frazer, Williams Fork, Troublesome, Blue, and Muddy rivers, which add their waters to the Grand before it leaves Middle Park. Eagle River comes in near Eagle, just above the point where the river enters Grand River Canyon, and Roaring Fork unites with it just below the mouth of the canyon at Glenwood Springs. At Grand Junction, Colo., the river receives the waters of its largest tributary, Gunnison River, and thereafter no other stream of importance enters until the Dolores comes in, 15 miles west of the Utah boundary.

A peculiar feature of the drainage is what might be termed its one-sided nature, practically all its important tributaries entering the river from the east. That part of the basin lying north and west of the Grand is much less extensive in area, is lower, and is generally broken and barren, and a considerable portion of the waters of its streams is diverted for irrigation.

The mountainous portion of the basin is still well covered with forests of spruce, quaking aspen, cedar, and piñon, and the forestation of the intermediate basin is fair. The controlling vegetation of the lower basin is sagebrush, chico, and cactus pads, with scattered pines, cedars, and piñons.

The precipitation ranges from 5 to 10 inches in the lower basin, 10 to 20 inches in the intermediate region, and 20 to 30 inches in the headwater region. By far the greater part of this is in the form of snow.

Natural storage within the basin is limited to a few small, high, mountain lakes. The stream channels of the upper basin are bordered to some extent by flat bottom lands, which are used as meadows and which are irrigated by a large number of small ditches. In the intermediate basin are a few small reservoirs storing snow and flood waters. A number of pumping plants also draw upon this district.

Irrigation is extensively practiced in the Uncompahgre, Gunnison, and Grand valleys, and a large project now under construction by the Reclamation Service will require 1,200 second-feet of the discharge of Gunnison River. The immense power possibilities of the Grand are at present but little developed.

NORTH FORK OF GRAND RIVER NEAR GRAND LAKE, COLO.

This station was established July 29, 1904. It is located at the highway bridge between Grand Lake and Hot Sulphur Springs, Colo., about 3 miles southwest of Grandlake post-office, in T. 3 N., R. 76 W. The nearest railroad station is at Granby, on the Denver, Northwestern and Pacific, 15 miles distant. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 70, where are given also references to publications that contain data for previous years.

Discharge measurements of North Fork of Grand River near Grandlake, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 17	M. C. Hinderlider	52	126	4.87	459
June 14	do	54	175	6.00	1,100
June 29	T. E. Brick	49	109	4.70	397
September 10	A. A. Weiland	40	57	3.59	45
December 16	R. I. Meeker	31	66	(a)	37

[a] Gage height affected by ice.

Daily gage height, in feet, of North Fork of Grand River near Grandlake, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.30	3.98	4.70	4.90	4.05	3.70	3.90	3.70	3.50
2	3.30	3.92	4.82	4.88	4.05	3.70	3.92	3.68	3.50
3	3.30	4.05	4.82	4.75	4.02	3.78	3.88	3.65	3.50
4	3.30	4.15	4.88	4.62	4.00	3.75	3.82	3.65	3.50
5	3.35	4.22	4.98	4.55	4.10	3.72	3.82	3.62	3.48
6	3.40	4.40	5.18	4.50	4.02	3.68	3.82	3.60	3.45
7	3.38	4.35	4.95	4.50	4.00	3.62	3.80	3.58	3.50
8	3.35	4.38	4.68	4.58	3.95	3.60	3.80	3.55	3.50
9	3.35	4.52	4.90	4.55	3.82	3.60	3.78	3.58	3.50
10	3.35	4.70	5.12	4.52	3.80	3.60	3.75	3.60	3.50
11	3.42	4.72	5.52	4.58	3.82	3.60	3.70	3.60	3.50
12	3.45	4.70	5.82	4.60	3.85	3.60	3.70	3.60	3.48
13	3.50	4.62	5.90	4.52	4.00	3.60	3.70	3.60	3.48
14	3.50	4.50	5.90	4.68	4.18	3.60	3.65	3.60	3.48
15	3.52	4.50	5.85	4.65	3.98	3.62	3.65	3.60	3.48
16	3.60	4.72	5.85	4.58	3.90	4.00	3.60	3.55	3.45
17	3.65	4.88	5.88	4.52	3.85	3.85	3.60	3.52	3.40
18	3.65	4.88	5.75	4.48	3.85	3.80	3.60	3.52	3.42
19	3.70	5.00	5.30	4.40	3.88	3.85	3.58	3.52	3.45
20	3.78	5.20	5.02	4.30	3.85	3.95	3.55	3.50	3.40
21	4.02	5.18	4.92	4.30	3.88	4.00	3.60	3.50	3.40
22	4.28	5.18	4.92	4.30	3.88	3.92	3.60	3.50	3.40
23	4.30	5.15	5.00	4.28	3.85	4.00	3.60	3.50	3.40
24	4.22	5.08	4.88	4.25	3.80	4.00	3.60	3.50	3.40
25	4.22	4.95	4.75	4.28	3.80	4.00	3.60	3.50	3.42
26	4.10	4.78	4.75	4.18	3.80	4.02	3.62	3.50	3.40
27	3.95	4.75	4.82	4.12	3.80	4.02	3.68	3.50	3.40
28	4.05	4.95	4.98	4.05	3.75	4.00	3.68	3.50	3.40
29	4.02	5.20	4.78	4.05	3.75	3.98	3.62	3.50	3.40
30	4.08	4.90	4.88	4.05	3.72	3.92	3.70	3.50	3.40
31	.....	4.75	.....	4.00	3.70	.....	3.70	.....	3.40

NOTE.—There was backwater from ice during a portion of November and December; gage heights have been corrected.

Rating table for North Fork of Grand River near Grandlake, Colo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.30	20	3.90	99	4.50	298	5.10	570	5.70	910
3.40	26	4.00	123	4.60	339	5.20	625	5.80	970
3.50	35	4.10	152	4.70	382	5.30	680	5.90	1,030
3.60	47	4.20	185	4.80	426	5.40	735		
3.70	62	4.30	221	4.90	472	5.50	790		
3.80	79	4.40	259	5.00	520	5.60	850		

NOTE.—The above table is applicable only for open-channel conditions. It is based on 4 discharge measurements made during 1906 and the form of the 1905 curve. It is well defined above gage height 3.5 feet.

Monthly discharge of North Fork of Grand River near Grandlake, Colo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	221	20	76.8	4,570
May	625	104	388	23,900
June	1,030	373	612	36,400
July	472	123	278	17,100
August	178	62	101	6,210
September	129	47	83.8	4,990
October	104	41	62.9	3,870
November	62	35	42.5	2,530
December	35	26	30.3	1,860
The period				101,000

NOTE.—Values are rated as follows: May to July, excellent; remainder of 1906, good.

GRAND LAKE OUTLET AT GRANDLAKE, COLO.

This station was established July 31, 1904. It is located at the footbridge at the west end of Grand Lake, about one-half mile south of Grandlake post-office, Colo., in sec. 6, T. 3 N., R. 75 W. The nearest railroad station is 18 miles distant, at Granby, on the Denver, Northwestern and Pacific Railway. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 72, where are given also references to publications that contain data for previous years.

Discharge measurements of Grand Lake Outlet, at Grandlake, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 18	M. C. Hinderlider	109	212	2.80	357
June 15	do	170	444	4.30	1,110
June 29	T. E. Brick	120	204	3.15	472
September 11	A. A. Weiland	110	75	1.80	47
December 16	R. I. Meeker	47	50	1.40	11

Daily gage height, in feet, of Grand Lake Outlet at Grandlake, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.15	1.98	2.82	3.50	2.35	1.75	2.10	1.70	1.45
2	1.20	1.92	2.90	3.48	2.35	1.88	2.05	1.70	1.40
3	1.18	1.90	2.95	3.35	2.35	2.05	2.00	1.70	1.40
4	1.20	1.85	2.92	3.18	2.30	2.05	2.00	1.70	1.42
5	1.20	1.90	3.10	3.20	2.30	2.02	1.98	1.68	1.45
6	1.22	1.95	3.45	3.05	2.25	1.98	1.95	1.65	1.45
7	1.30	2.02	3.20	2.98	2.25	1.95	1.90	1.65	1.45
8	1.32	2.02	2.92	2.90	2.22	1.90	1.90	1.62	1.45
9	1.32	2.12	2.95	2.92	2.20	1.85	1.88	1.60	1.45
10	1.38	2.30	3.30	2.95	2.15	1.80	1.85	1.60	1.45
11	1.40	2.48	3.78	3.02	2.10	1.80	1.85	1.60	1.45
12	1.45	2.58	4.00	3.10	2.10	1.75	1.82	1.58	1.42
13	1.48	2.62	4.28	3.22	2.10	1.75	1.80	1.55	1.40
14	1.50	2.52	4.27	3.35	2.10	1.72	1.75	1.58	1.40
15	1.52	2.42	4.15	3.30	2.10	1.70	1.75	1.55	1.40
16	1.55	2.52	4.28	3.15	2.05	1.88	1.75	1.55	1.40
17	1.58	2.65	4.22	3.00	2.05	1.90	1.72	1.55	1.38
18	1.68	2.80	3.65	2.92	2.00	1.90	1.70	1.55	1.35
19	1.72	2.98	3.48	2.82	2.00	1.95	1.70	1.52	1.35
20	1.75	3.20	3.40	2.78	2.00	1.95	1.70	1.50	1.35
21	1.82	3.25	3.40	2.78	2.00	2.00	1.68	1.45	1.35
22	1.92	3.38	3.32	2.72	2.10	2.05	1.65	1.45	1.35
23	2.02	3.48	3.40	2.72	2.12	2.10	1.65	1.45	1.35
24	2.18	3.35	3.20	2.75	2.08	2.10	1.65	1.45	1.35
25	2.20	3.12	2.98	2.78	2.05	2.08	1.65	1.45	1.35
26	2.15	2.88	2.88	2.68	1.98	2.08	1.65	1.45	1.35
27	2.08	2.82	3.10	2.58	1.90	2.25	1.65	1.45	1.38
28	2.02	2.92	3.22	2.50	1.85	2.25	1.65	1.45	1.40
29	2.00	3.22	3.18	2.48	1.82	2.20	1.70	1.45	1.40
30	2.00	3.15	3.32	2.42	1.80	2.18	1.70	1.45	1.40
31	.....	2.92	.....	2.35	1.75	.....	1.70	.....	1.40

NOTE.—From May 27 to June 14, the gage heights were affected by an obstruction of logs at the outlet of the lake; they have been corrected, but are still liable to slight error.

Rating table for Grand Lake Outlet at Grandlake, Colo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.15	3	1.80	47	2.50	224	3.20	515	3.90	890
1.20	4	1.90	64	2.60	260	3.30	565	4.00	945
1.30	7	2.00	84	2.70	298	3.40	615	4.10	1,000
1.40	11	2.10	106	2.80	338	3.50	670	4.20	1,055
1.50	16	2.20	131	2.90	379	3.60	725	4.30	1,110
1.60	23	2.30	159	3.00	420	3.70	780		
1.70	33	2.40	190	3.10	465	3.80	835		

NOTE—The above table is applicable only for open-channel conditions. It is based on 5 discharge measurements made during 1906 and is well defined.

Monthly discharge of Grand Lake Outlet at Grandlake, Colo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	131	3	40.6	2,420
May	659	56	296	18,200
June	1,100	346	628	37,400
July	670	174	402	24,700
August	174	40	107	6,580
September	145	33	79.2	4,710
October	106	28	48.5	2,980
November	33	14	21.0	1,250
December	14	9	11.2	689
The period				98,900

NOTE.—Values are rated as follows: May, July and August, excellent; remainder of 1906, good.

NORTH INLET TO GRAND LAKE AT GRANDLAKE, COLO.

This station was established August 3, 1905, and was discontinued July 22, 1906. It is located at the footbridge which crosses the stream about 100 yards north and 300 yards east of Grandlake post-office in sec. 5, T. 3 N., R. 75 W.

The conditions at this station and the bench marks are described in Water-Supply Paper 175, page 75.

Discharge measurements of North Inlet to Grand Lake at Grandlake, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 17	M. C. Hinderlider	49	88	2.95	223
June 14	do	59	162	4.00	644
June 29	T. E. Brick	49	88	3.10	243
September 10	A. A. Weiland	47	39	2.12	28
December 15	R. I. Meeker	8	7.4	.....	8

Daily gage height, in feet, of North Inlet to Grand Lake at Grandlake, Colo., for 1906.

Day.	May.	June.	July.	Day.	May.	June.	July.
1	.....	3.10	3.24	17	2.70	3.72	2.97
2	.....	3.05	3.24	18	2.85	3.64	2.90
3	2.25	3.10	3.20	19	2.95	3.34	2.82
4	2.35	3.12	3.20	20	3.00	3.24	2.77
5	2.48	3.02	3.20	21	3.05	3.22	2.72
6	2.55	2.98	3.16	22	3.20	3.20	2.72
7	2.45	2.95	3.16	23	3.25	3.20	.....
8	2.55	2.88	3.12	24	3.20	3.14	.....
9	2.72	3.08	3.14	25	3.10	3.14	.....
10	2.82	3.50	3.20	26	3.02	3.10	.....
11	2.90	3.75	3.22	27	3.08	3.10	.....
12	2.82	3.90	3.17	28	2.98	3.04	.....
13	2.78	4.00	3.12	29	3.00	3.04	.....
14	2.72	4.00	3.04	30	3.05	3.04	.....
15	2.68	3.74	3.04	31	3.05	.....	.....
16	2.75	3.74	3.04				

GRAND RIVER AT HOT SULPHUR SPRINGS, COLO.

This station was established July 27, 1904. It was located at the highway bridge one-eighth mile below Hot Sulphur Springs, Colo., in sec. 3, T. 1 N., R. 78 W., and is 5 miles above the mouth of Williams Fork River.

On April 16, 1906, the station was removed to a new highway bridge, about 1,000 feet above the old station, where conditions are much more favorable for measurements.

On May 22, a standard wire gage was installed; length of chain, 19.17 feet. The bench mark is a cross cut in the west face of a foundation stone near the southwest corner of the Riverside Bar and Café building, near the east end of the bridge; elevation, 20.04 feet above the datum of the gage.

Discharge measurements of Grand River at Hot Sulphur Springs, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.		Discharge.
				Old gage.	New gage.	
		Feet.	*Sq. ft.*	*Feet.*	*Feet.*	*Sec.-ft.*
April 14	M. C. Hinderlider	88	97	3.55	1.65	224
April 16	do	98	150	4.10	2.25	520
May 19	do	137	424	7.20	4.40	3,240
May 22	do	148	507	7.85	5.24	3,920
June 16	do	310	831	9.35	6.06	5,360
June 30	T. E. Brick	133	403	6.50	4.12	2,320
September 9	A. A. Weiland	98	148	.....	1.82	286
December 14	R. I. Meeker	92	159	.....	(a)	175

[a] Gage height affected by ice 0.5 to 1.0 foot thick.

Daily gage height, in feet, of Grand River at Hot Sulphur Springs, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	4.22	2.45	4.05	4.30	2.55	1.90	2.20	1.70
2	4.18	2.45	4.15	4.25	2.60	2.25	2.20	1.70
3	3.98	2.45	4.25	4.05	2.48	2.25	2.15	1.70
4	4.38	2.80	4.10	3.85	2.45	2.15	2.15	1.70
5	4.55	2.95	4.30	3.75	2.45	2.00	2.15	1.70
6	4.60	3.10	4.85	3.65	2.40	1.95	2.10	1.70
7	4.50	3.00	4.40	3.60	2.40	1.92	2.08	1.70
8	4.10	3.30	4.10	3.65	2.30	1.85	2.00	1.70
9	4.22	3.40	4.00	3.68	2.20	1.80	2.00	1.72
10	4.40	3.55	4.05	3.65	2.20	1.80	2.00	1.78
11	4.55	3.55	4.85	3.65	2.10	1.80	2.00	1.82
12	4.25	3.40	5.50	3.62	2.10	1.70	2.00	1.78
13	3.90	3.75	6.05	3.70	2.15	1.72	2.00	1.75
14	3.65	3.70	6.05	4.00	2.20	1.75	1.90	1.70
15	3.58	3.60	6.05	3.85	2.40	1.78	1.90	1.70
16	3.92	3.80	6.05	3.65	2.20	2.20	1.85	1.70
17	2.55	4.30	6.00	3.48	2.10	2.20	1.85	1.70
18	2.45	4.35	5.25	3.30	2.10	2.20	1.80	1.70
19	2.65	4.55	4.88	3.18	2.10	2.25	1.80	.....
20	2.50	4.65	4.72	3.10	2.10	2.25	1.80	.....
21	2.72	4.80	4.55	3.00	2.10	2.22	1.75	.....
22	3.05	4.85	4.60	3.00	2.10	2.30	1.75	.....
23	3.20	5.00	4.65	2.90	2.10	2.30	1.80	.....
24	3.40	4.85	4.25	3.20	2.10	2.30	1.80	.....
25	3.00	4.68	3.95	3.15	2.10	2.40	1.80	.....
26	2.90	4.40	3.85	2.90	2.10	2.60	1.80	.....
27	2.50	4.30	4.15	2.70	2.10	2.60	1.75	.....
28	2.65	4.30	4.05	2.70	2.05	2.55	1.75	.....
29	2.45	4.80	4.05	2.60	1.95	2.40	1.75	.....
30	2.65	4.50	4.10	2.60	1.88	2.30	1.75	.....
31	.....	4.15	.....	2.55	1.90	.....	1.70	.....

NOTE.—Gage heights for April 1 to 16 are for the old station; those for April 17 to May 22 are from a temporary staff gage at the new station, having the same datum as the wire gage which was used after May 22.

Rating tables for Grand River at Hot Sulphur Springs, Colo.

MAY 1, 1905, TO APRIL 16, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.60	240	3.90	360	4.10	450	4.30	560	4.50	680
3.70	280	4.00	400	4.20	500	4.40	620	4.60	750
3.80	320								

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6 and is well defined. This table is for the old station.

Rating tables for Grand River at Hot Sulphur Springs, Colo.—Continued.

APRIL 17 TO NOVEMBER 18, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.70	240	2.50	680	3.30	1,375	4.10	2,360	4.90	3,550
1.80	280	2.60	750	3.40	1,480	4.20	2,500	5.00	3,700
1.90	325	2.70	825	3.50	1,590	4.30	2,650	5.20	4,000
2.00	375	2.80	905	3.60	1,710	4.40	2,800	5.40	4,310
2.10	430	2.90	990	3.70	1,830	4.50	2,950	5.60	4,630
2.20	490	3.00	1,080	3.80	1,960	4.60	3,100	5.80	4,950
2.30	550	3.10	1,175	3.90	2,090	4.70	3,250	6.00	5,270
2.40	615	3.20	1,275	4.00	2,220	4.80	3,400	6.20	5,590

[a] This table is applicable only for open-channel conditions. It is based on 7 discharge measurements made during 1906 and is fairly well defined. This table is for the new station.

Monthly discharge of Grand River at Hot Sulphur Springs, Colo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	1,480	234	691	41,100
May	3,700	648	2,160	133,000
June	5,350	2,020	3,210	191,000
July	2,650	715	1,530	94,100
August	750	316	491	30,200
September	750	240	457	27,200
October	490	240	338	20,800
November (1-18)	289	240	248	8,850
The period				546,000

NOTE.—The above values are excellent.

GRAND RIVER NEAR KREMMLING, COLO.

This station was established July 24, 1904. It is located at the mouth or upper end of Gore Canyon, about 3 miles southwest of Kremmling, Colo. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 78, where are given also references to publications that contain data for previous years.

Discharge measurements of Grand River near Kremmling, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 4	M. C. Hinderlider	110	539	2.62	707
May 21	do	150	2,188	12.28	7,730
June 22	T. E. Brick	141	2,136	11.20	6,540
July 3	do	133	1,791	9.25	4,500
September 9	A. A. Weiland	110	458	2.88	913
October 18	R. I. Meeker	105	307	2.00	657
December 13[a]	do	100	234	1.20	483

[a] River frozen along left bank; slush ice running.

Daily gage height, in feet, of Grand River near Kremmling, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.2	4.7	10.3	9.45	5.1	3.0	2.85	2.05	1.6
2	3.5	4.65	10.4	9.5	5.5	3.1	3.45	2.35	1.3
3	2.85	5.0	10.4	9.15	5.05	4.35	3.45	2.3	1.25
4	3.75	5.35	10.3	8.75	4.85	3.9	3.5	2.1	1.3
5	2.8	6.7	10.55	8.5	4.7	3.55	3.45	2.0	1.5
6	3.4	7.35	11.75	8.3	4.7	3.3	3.25	1.9	1.15
7	4.2	7.2	11.4	8.15	4.9	3.05	3.25	1.6	1.5
8	3.75	7.5	9.7	8.25	4.65	3.0	3.15	1.6	1.25
9	3.7	8.2	9.55	8.15	4.4	2.9	3.05	1.7	1.25
10	4.0	9.2	10.75	8.2	4.15	3.0	2.85	1.6	1.2
11	4.35	9.6	12.3	8.3	4.05	2.95	2.7	1.7	1.2
12	4.3	9.9	13.45	8.45	3.95	2.8	2.65	1.6	1.6
13	3.25	9.65	14.6	8.45	4.0	2.45	2.55	1.3	1.15
14	2.65	8.8	15.25	8.8	4.2	2.5	2.45	1.5	1.15
15	2.8	8.4	15.25	8.9	4.45	2.85	2.3	1.75	1.4
16	3.3	9.3	15.1	8.45	4.2	3.75	2.2	1.8	.6
17	4.55	10.4	14.95	7.8	4.0	4.1	2.15	1.3	.85
18	5.35	10.9	13.7	7.4	3.95	3.75	2.0	.7	.5
19	4.55	11.4	13.0	7.2	3.85	3.65	1.85	.95	.45
20	4.9	12.1	12.5	6.8	3.75	3.9	2.1	.8	.6
21	5.6	12.2	12.0	6.6	3.9	3.8	2.0	.75	.65
22	6.35	12.55	11.5	6.6	4.8	3.7	1.6	1.1	1.0
23	7.2	12.8	11.1	6.5	4.65	3.8	1.9	1.05	.95
24	7.5	12.4	10.85	6.6	4.35	3.7	2.2	1.0	.95
25	6.4	11.85	9.8	6.9	4.1	3.65	2.35	1.35	1.1
26	6.1	11.4	9.55	6.35	3.45	4.1	2.15	1.35	.8
27	5.2	10.5	9.65	5.95	3.45	4.85	2.2	1.0	1.15
28	5.0	10.8	9.75	5.9	3.25	4.55	2.2	.95	1.5
29	5.0	12.05	9.35	5.55	3.05	4.2	2.15	1.4	1.2
30	4.9	12.05	9.2	5.3	3.05	4.0	2.1	1.55	1.1
31	.....	10.6	.....	5.15	3.0	.....	2.05	.....	1.2

NOTE.—These gage heights are liable to error, on account of uncertainties of the gage datum. River frozen after about December 10.

Rating table for Grand River near Kremmling, Colo.

JANUARY 1, 1905, TO JULY 3, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.60	260	1.80	490	3.00	830	4.40	1,330	6.80	2,530
.70	275	1.90	515	3.10	865	4.60	1,410	7.00	2,670
.80	290	2.00	540	3.20	900	4.80	1,490	8.00	3,410
.90	305	2.10	565	3.30	935	5.00	1,570	9.00	4,260
1.00	320	2.20	590	3.40	970	5.20	1,650	10.00	5,210
1.10	340	2.30	620	3.50	1,005	5.40	1,750	11.00	6,270
1.20	360	2.40	650	3.60	1,040	5.60	1,850	12.00	7,390
1.30	380	2.50	680	3.70	1,075	5.80	1,950	13.00	8,600
1.40	400	2.60	710	3.80	1,110	6.00	2,050	14.00	9,900
1.50	420	2.70	740	3.90	1,145	6.20	2,170	15.00	11,220
1.60	440	2.80	770	4.00	1,180	6.40	2,290		
1.70	465	2.90	800	4.20	1,250	6.60	2,410		

JULY 4 TO DECEMBER 10, 1906.[b]

0.70	405	1.80	610	2.90	925	4.00	1,320	6.20	2,360
.80	420	1.90	635	3.00	960	4.20	1,400	6.40	2,480
.90	435	2.00	660	3.10	995	4.40	1,480	6.60	2,600
1.00	450	2.10	685	3.20	1,030	4.60	1,570	6.80	2,720
1.10	465	2.20	710	3.30	1,065	4.80	1,660	7.00	2,850
1.20	485	2.30	740	3.40	1,100	5.00	1,750	8.00	3,530
1.30	505	2.40	770	3.50	1,135	5.20	1,840	9.00	4,300
1.40	525	2.50	800	3.60	1,170	5.40	1,940		
1.50	545	2.60	830	3.70	1,205	5.60	2,040		
1.60	565	2.70	860	3.80	1,240	5.80	2,140		
1.70	585	2.80	890	3.90	1,280	6.00	2,250		

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–6 and is well defined above gage height 1.6 feet.

[b] This table is applicable only for open-channel conditions. It is based on 3 discharge measurements made during September to December, 1906, and earlier high-water measurements, and is well defined above gage height 1.2 feet.

Monthly discharge of Grand River near Kremmling, Colo., for 1906.

[Drainage area, 2,380 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	3,020	725	1,440	85,700	0.605	0.68
May	8,350	1,430	5,060	311,000	2.13	2.46
June	11,600	4,440	7,080	421,000	2.97	3.31
July	4,710	1,820	3,290	202,000	1.38	1.59
August	1,990	960	1,400	86,100	.588	.68
September	1,680	785	1,160	69,000	.487	.54
October	1,140	565	817	50,200	.343	.40
November	755	405	546	32,500	.229	.26
December	565	[a] 450	[a] 477	29,300	.200	.23
The period				1,290,000		

[a] Discharge estimated December 11 to 31.

NOTE.—The accuracy of the above values is a matter of conjecture on account of the uncertainty of the gage heights.

GRAND RIVER, NEAR WOLCOTT, COLO.

This station was established May 27, 1906. It is located at the State bridge, 13 miles north of Wolcott.

A chain gage is attached to the downstream side of the bridge; length of chain 20.88 feet. The gage is read by D. O. Bailey.

Discharge measurements of Grand River near Wolcott, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 27	R. I. Meeker	152	848	6.70	6,230
June 17	do	190	1,231	8.65	11,800
July 13	T. E. Brick	142	637	5.35	4,400
November 22	R. I. Meeker	61	177	1.80	428

Daily gage height, in feet, of Grand River near Wolcott, Colo., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		6.7	6.2	3.6	2.5	3.2	2.3	1.8
2		6.78	6.05	3.7	2.5	3.1	2.3	1.8
3		7.05	5.85	3.55	2.6	3.05	2.4	1.9
4		7.0	5.65	3.5	2.6	3.0	2.4	1.9
5		6.75	5.5	3.5	2.7	2.9	2.35	1.9
6		6.75	5.35	3.5	2.7	2.85	2.3	1.95
7		6.7	5.3	3.5	2.6	2.8	2.3	2.0
8		6.45	5.4	3.45	2.6	2.8	2.2	2.0
9		6.6	5.35	3.2	2.6	2.7	2.2	2.0
10		7.05	5.3	3.2	2.6	2.6	2.1	2.0
11		7.75	5.35	3.1	2.6	2.55	2.1	2.0
12		8.75	5.3	3.0	2.55	2.5	2.05	2.1
13		8.35	5.3	3.0	2.4	2.4	2.0	2.1
14		8.15	5.45	2.85	2.3	2.4	2.0	2.1
15		8.85	5.55	2.9	2.45	2.4	1.9	2.1
16		8.7	5.45	3.0	2.65	2.3	1.9	2.1
17		8.7	5.25	3.0	2.7	2.3	1.8	2.1
18		8.35	4.85	2.9	2.8	2.25	1.8	2.1
19		7.35	4.7	2.9	2.9	2.2	1.8	2.1
20		7.0	4.6	2.85	2.9	2.2	1.75	2.0
21		6.9	4.4	2.8	3.05	2.2	1.7	2.0
22		6.85	4.3	2.8	3.15	2.1	1.7	2.0
23		6.9	4.3	2.85	3.35	2.1	1.7	1.9
24		6.5	4.3	2.9	3.5	2.15	1.75	1.85
25		6.15	4.25	2.8	3.6	2.2	1.75	1.85
26		6.05	4.2	2.75	3.7	2.3	1.7	1.75
27	6.7	5.9	4.1	2.75	3.8	2.3	1.8	1.7
28	6.7	5.9	4.0	2.7	3.7	2.4	1.8	1.7
29	7.3	5.9	3.9	2.6	3.45	2.35	1.8	1.75
30	7.35	6.05	3.85	2.6	3.2	2.4	1.75	1.75
31	6.85		3.65	2.6		2.35		1.8

Rating table for Grand River near Wolcott, Colo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.70	385	2.70	1,015	3.70	1,970	4.70	3,260	6.40	6,230
1.80	430	2.80	1,095	3.80	2,080	4.80	3,410	6.60	6,640
1.90	480	2.90	1,180	3.90	2,200	4.90	3,560	6.80	7,060
2.00	535	3.00	1,270	4.00	2,320	5.00	3,720	7.00	7,500
2.10	595	3.10	1,360	4.10	2,440	5.20	4,040	7.20	7,950
2.20	655	3.20	1,450	4.20	2,570	5.40	4,380	7.40	8,410
2.30	720	3.30	1,545	4.30	2,700	5.60	4,720	7.60	8,890
2.40	790	3.40	1,645	4.40	2,830	5.80	5,080	7.80	9,380
2.50	860	3.50	1,750	4.50	2,970	6.00	5,450	8.00	9,880
2.60	935	3.60	1,860	4.60	3,110	6.20	5,830	9.00	12,600

NOTE.—The above table is applicable only for open-channel conditions. It is based on 4 discharge measurements made during 1906 and is fairly well defined.

Monthly discharge of Grand River near Wolcott, Colo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May (27-31)	8,300	6,850	7,470	74,100
June	12,200	5,260	7,850	467,000
July	5,830	1,920	3,700	228,000
August	1,970	935	1,320	81,200
September	2,080	720	1,200	71,400
October	1,450	595	874	53,700
November	790	385	539	32,100
December	595	385	505	31,100
The period				1,030,000

NOTE.—The above values are good.

GRAND RIVER AT GLENWOOD SPRINGS, COLO.

This station is located in the mountains, midway between the Continental Divide and the Colorado-Utah boundary line, and just above the third large tributary of the Grand, which is called Roaring Fork. It was established May 12, 1899, at the request of the Denver and Rio Grande Railroad Company, and is located at the State street bridge. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 81, where are given also references to publications that contain data for previous years.

Discharge measurements of Grand River at Glenwood Springs, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 8	R. I. Meeker	195	705	4.84	2,240
May 4	do	205	851	5.65	3,350
May 19	E. C. Murphy	217	1,610	8.50	13,900
May 28	R. I. Meeker	214	1,390	8.02	11,300
June 19	do	217	1,560	8.95	15,100
July 15	T. E. Brick	214	1,220	7.20	7,060
November 21	R. I. Meeker	185	449	3.58	810

Daily gage height, in feet, of Grand River at Glenwood Springs, Colo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.25	3.32	3.62	4.62	5.50	7.92	7.40	5.92	4.60	5.80	4.15	3.80
2	3.25	3.30	3.45	4.65	5.42	7.92	7.45	5.95	4.68	5.60	4.15	3.80
3	3.25	3.32	3.40	4.49	5.52	8.00	7.38	6.02	4.65	5.40	4.22	3.78
4	3.28	3.38	3.48	4.29	5.60	7.95	7.30	5.90	5.22	5.20	4.20	3.82
5	3.22	3.35	3.55	4.17	6.10	7.98	7.10	5.85	5.18	5.00	4.12	3.80
6	3.22	3.40	3.50	4.29	6.55	8.62	7.00	5.88	5.08	4.80	4.10	3.72
7	3.28	3.38	3.55	4.62	6.80	8.68	6.95	5.88	5.02	4.70	4.12	3.70
8	3.28	3.35	3.58	4.80	6.90	8.00	6.90	5.60	5.02	4.60	4.18	3.60
9	3.22	3.32	3.68	4.65	7.12	7.80	6.90	5.22	5.02	4.50	4.00	3.68
10	3.22	3.40	3.68	4.62	7.50	8.05	6.90	5.12	5.00	4.40	3.98	3.65
11	3.25	3.4	3.80	4.95	7.80	8.98	6.92	5.02	5.02	4.35	3.98	3.70
12	3.25	3.38	3.82	5.00	7.90	9.78	6.95	5.02	5.08	4.35	4.00	3.72
13	3.30	3.40	3.92	4.98	7.80	10.42	7.00	4.92	5.00	4.30	4.02	3.78
14	3.22	3.40	3.92	4.68	7.45	10.70	7.00	4.92	5.02	4.25	3.95	3.60
15	3.22	3.38	3.78	4.48	7.32	10.60	7.18	4.98	5.12	4.25	4.00	3.40
16	3.20	3.38	3.72	4.45	7.48	10.58	7.08	5.02	5.32	4.18	4.05	3.10
17	3.30	3.40	3.60	4.78	7.95	10.38	6.95	5.02	5.60	4.12	4.08	2.95
18	3.35	3.42	3.52	5.15	8.28	9.90	6.75	4.92	5.80	4.12	3.92	2.98
19	3.28	3.42	3.48	5.42	8.62	8.88	6.55	4.92	5.85	4.12	3.62	3.22
20	3.35	3.40	3.45	5.32	8.95	8.48	6.45	4.85	5.90	4.10	3.32	3.32
21	3.25	3.42	3.60	5.55	9.12	8.25	6.30	4.90	5.95	4.18	3.52	3.48
22	3.05	3.48	3.60	5.88	9.12	8.12	6.25	4.98	6.25	4.18	3.68	3.52
23	3.22	3.42	3.75	6.35	9.25	8.12	6.20	5.12	6.15	4.10	3.68	3.48
24	3.32	3.38	4.02	6.68	9.05	7.98	6.20	5.12	6.12	3.82	3.75	3.55
25	3.32	3.42	4.25	6.52	8.65	7.60	6.22	5.08	6.12	4.05	3.72	3.58
26	3.30	3.38	4.48	6.15	8.42	7.48	6.30	4.95	6.18	4.12	3.72	3.52
27	3.28	3.42	4.48	5.95	8.02	7.45	6.12	4.82	6.30	4.20	3.62	3.58
28	3.28	3.50	4.48	5.65	8.02	7.45	6.02	4.78	6.42	4.20	3.68	3.52
29	3.28	.....	4.45	5.58	8.45	7.38	6.10	4.68	6.30	4.25	3.78	3.55
30	3.28	.....	4.55	5.58	8.68	7.30	5.92	4.65	6.00	4.22	3.70	3.42
31	3.28	.....	4.48	.....	8.10	.....	5.85	4.62	.....	4.20	.....	3.42

Rating table for Grand River at Glenwood Springs, Colo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.90	430	3.90	1,080	4.90	2,290	5.90	4,000	7.80	9,380
3.00	480	4.00	1,180	5.00	2,440	6.00	4,210	8.00	10,210
3.10	530	4.10	1,290	5.10	2,590	6.20	4,640	8.20	11,110
3.20	580	4.20	1,400	5.20	2,740	6.40	5,090	8.40	12,090
3.30	630	4.30	1,510	5.30	2,890	6.60	5,580	8.60	13,160
3.40	690	4.40	1,630	5.40	3,050	6.80	6,110	8.80	14,350
3.50	760	4.50	1,750	5.50	3,220	7.00	6,670	9.00	15,660
3.60	830	4.60	1,870	5.60	3,400	7.20	7,260	10.00	22,600
3.70	910	4.70	2,000	5.70	3,590	7.40	7,910		
3.80	990	4.80	2,140	5.80	3,790	7.60	8,620		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1900-1906 and is well defined.

Monthly discharge of Grand River at Glenwood Springs, Colo., for 1906.

[Drainage area, 4,520 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	660	505	610	37,500	0.135	0.16
February	760	630	685	38,000	.152	.16
March	1,810	690	1,060	65,200	.235	.27
April	5,790	1,370	2,780	165,000	.615	.69
May	17,400	3,080	9,750	600,000	2.16	2.49
June	27,600	7,580	13,900	827,000	3.08	3.44
July	8,080	3,900	5,930	365,000	1.31	1.51
August	4,250	1,900	2,770	170,000	.613	.71
September	5,140	1,870	3,340	199,000	.739	.82
October	3,790	1,010	1,730	106,000	.383	.44
November	1,420	642	1,100	65,500	.243	.27
December	1,010	455	801	49,300	.177	.20
The year	27,600	455	3,700	2,690,000	.820	11.16

NOTE.—Values are rated as follows: January, February, and December, good; remainder of 1906 excellent.

GRAND RIVER NEAR PALISADES, COLO.

This station was established April 9, 1902. It is located at the steel highway bridge at the point where the river enters Grand Valley, 2 miles above Palisades, in T. 11 S., R. 98 W., and is above all irrigating ditches supplying water to Grand Valley, with the exception of one pumping plant, which takes about 20 second-feet from the river one-fourth mile above the station. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 84, where are given also references to publications that contain data for previous years.

Discharge measurements of Grand River near Palisades, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 9	R. I. Meeker	280	930	13.70	3,640
May 5	do	316	1,537	15.60	7,990
May 29	do	379	2,869	19.95	24,900
June 18	do	396	3,402	21.20	30,900
June 29	do	321	2,194	17.65	15,100
July 16	T. E. Brick	321	2,034	16.90	12,300
November 19	R. I. Meeker	255	621	12.60	1,740

Daily gage height, in feet, of Grand River near Palisades, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	12.8	14.9	19.05	16.95	14.55	13.1	14.0
2	12.8	14.8	19.15	16.95	14.7	13.2	13.9
3	12.9	14.75	19.15	16.85	14.7	13.35	13.8
4	12.9	15.0	19.15	17.1	14.55	13.5	13.8
5	13.0	15.6	19.25	16.85	14.35	13.6	13.8
6	13.0	16.45	19.75	16.5	14.25	13.5	13.75
7	13.7	16.9	19.85	16.65	14.15	13.35	13.7
8	13.9	17.15	19.3	16.85	14.2	13.2	13.65
9	13.6	17.5	18.9	16.65	14.15	13.2	13.6
10	13.65	18.05	19.3	16.8	13.95	13.2	13.55
11	13.85	18.65	20.3	16.8	13.85	13.1	13.5
12	14.0	18.95	21.0	16.7	13.7	13.1	13.4
13	13.75	18.85	21.8	16.8	13.85	13.1	13.4
14	13.7	18.25	22.25	16.85	13.85	13.1	13.3
15	13.5	17.75	22.05	17.1	13.75	14.25	13.2
16	13.45	18.1	22.05	17.0	13.75	13.75	13.2
17	13.7	18.75	22.05	16.6	13.8	13.8	13.2
18	14.1	19.3	21.25	16.3	13.75	13.8	13.1
19	14.5	19.75	20.25	16.15	13.7	13.8	13.1
20	14.55	20.4	19.75	15.85	13.65	13.8	13.1
21	14.65	20.45	19.45	15.65	13.65	13.8	13.2
22	15.05	20.65	19.25	15.55	13.6	13.8	13.2
23	15.6	20.7	19.05	15.5	13.7	13.8	13.2
24	16.3	20.75	18.5	15.45	13.9	13.8	13.05
25	16.35	20.35	18.2	15.4	13.75	13.85	12.95
26	15.95	19.5	17.85	15.4	13.55	13.85	13.15
27	15.45	19.05	17.55	15.2	13.45	14.25	13.2
28	15.25	19.25	17.35	15.05	13.35	14.4	13.2
29	15.2	19.75	17.4	14.9	13.3	14.3	13.2
30	15.0	19.9	16.9	14.8	13.15	14.2	13.2
31	.....	19.5	.....	14.6	13.1	.....	13.2

Rating table for Grand River near Palisades, Colo., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
12.80	1,950	13.80	3,640	14.80	5,880	15.80	8,480	17.60	14,630
12.90	2,070	13.90	3,850	14.90	6,120	15.90	8,770	17.80	15,430
13.00	2,200	14.00	4,060	15.00	6,360	16.00	9,070	18.00	16,250
13.10	2,350	14.10	4,270	15.10	6,610	16.20	9,680	19.00	20,530
13.20	2,510	14.20	4,490	15.20	6,860	16.40	10,320	20.00	25,160
13.30	2,680	14.30	4,710	15.30	7,120	16.60	10,980	21.00	30,210
13.40	2,860	14.40	4,940	15.40	7,380	16.80	11,660	22.00	35,590
13.50	3,050	14.50	5,170	15.50	7,650	17.00	12,370	23.00	41,090
13.60	3,240	14.60	5,400	15.60	7,920	17.20	13,100		
13.70	3,440	14.70	5,640	15.70	8,200	17.40	13,850		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1906 and is well defined.

Monthly discharge of Grand River near Palisades, Colo., for 1906.

[Drainage area, 8,550 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
April	10,200	1,950	4,730	281,000	0.553	0.62
May	28,900	5,700	18,600	1,140,000	2.18	2.51
June	37,000	12,000	23,500	1,400,000	2.75	3.07
July	12,700	5,400	9,820	604,000	1.15	1.33
August	5,640	2,350	3,800	234,000	0.444	.51
September	4,940	2,350	3,340	199,000	0.391	.44
October	4,060	2,140	2,850	175,000	0.333	.38
The period				4,030,000		

NOTE.—The above values are excellent.

FRASER RIVER DRAINAGE BASIN.

FRASER RIVER AT GRANBY, COLO.

Fraser River rises among the peaks of the Front Range in southeastern Grand County, Colo., and flows in a general northwesterly direction to its point of junction with Grand River in the east-central part of Middle Park. The stream receives a number of small tributaries, among which are Elk, St. Louis, Crooked, and Pole creeks, all short mountain streams draining the eastern slopes of the Vasquez Mountains.

The gaging station was established July 28, 1904. It is located on the main road between Coulter and Grand Lake, at the wagon bridge three-fourths mile southwest of Granby and about 4 miles above the mouth of the river, in sec. 9, T. 1 N., R. 76 W. In the 1904 Progress Report this station was called Fraser River, near Coulter, Colo. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 87.

Discharge measurements of Fraser River at Granby, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 16	M. C. Hinderlider	57	149	5.57	472
May 23	do	58	179	6.10	835
June 16	do	61	233	6.57	1,550
June 30	T. E. Brick	58	164	5.65	621
September 10	A. A. Weiland	52	95	4.65	114
December 17 [a]	R. I. Meeker	28	27	.....	51

[a] Ice 1.5 feet thick.

Daily gage height, in feet, of Fraser River at Granby, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	.....	4.9	5.9	5.65	4.9	4.7	4.7	4.6
2	.....	5.0	5.9	5.65	4.95	4.95	4.8	4.6
3	.....	5.1	5.95	5.6	4.9	4.85	4.8	4.6
4	.....	5.35	5.9	5.5	4.85	4.65	4.7	4.6
5	.....	5.45	6.05	5.4	4.9	4.65	4.7	4.6
6	.....	5.4	6.2	5.5	4.9	4.6	4.6	4.6
7	.....	5.25	6.05	5.55	4.85	4.5	4.6	4.6
8	.....	5.3	5.9	5.55	4.8	4.55	4.6	4.45
9	.....	5.45	6.0	5.35	4.75	4.6	4.6	4.45
10	.....	5.6	6.2	5.35	4.8	4.55	4.6	4.4
11	.....	5.05	6.45	5.45	4.75	4.5	4.7	4.4
12	.....	5.6	6.6	5.5	4.7	4.5	4.7	4.45
13	.....	5.55	6.75	5.45	4.7	4.5	4.7	4.5
14	.....	5.25	6.85	5.35	4.75	4.5	4.7	4.5
15	5.35	5.42	6.85	5.2	4.75	4.5	4.7	4.5
16	5.25	5.65	6.7	5.1	4.7	4.7	4.6	4.5
17	5.5	5.85	6.65	4.95	4.7	4.7	4.6	4.4
18	5.2	5.85	6.45	4.85	4.7	4.7	4.6	4.4
19	5.15	5.95	6.2	4.85	4.7	4.7	4.6	4.4
20	5.27	6.05	6.1	5.05	4.7	4.7	4.6	4.4
21	5.5	6.0	6.05	5.0	4.95	4.65	4.6	4.3
22	5.68	6.1	6.05	5.05	5.0	4.6	4.6	4.3
23	5.7	6.2	6.1	4.95	4.85	4.6	4.6	4.3
24	5.45	6.1	5.85	4.95	4.8	4.6	4.6	4.3
25	5.2	6.05	5.65	4.95	4.75	4.6	4.6	4.3
26	5.2	6.0	5.65	5.05	4.7	4.7	4.6	4.3
27	5.35	5.9	5.75	5.0	4.7	4.7	4.6	4.3
28	4.92	6.05	5.8	5.0	4.7	4.7	4.6	4.3
29	5.15	6.15	5.65	5.0	4.7	4.7	4.6	4.3
30	5.0	6.05	5.65	5.0	4.7	4.7	4.6	4.3
31	.....	5.9	.....	4.9	4.7	.....	4.6	.....

NOTE.—Ice conditions prevailed after November 16.

Rating tables for Fraser River at Granby, Colo.

APRIL 15 TO JUNE 12, 1906. [a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.90	140	5.30	300	5.70	550	6.10	900	6.50	1,300
5.00	170	5.40	350	5.80	630	6.20	1,000	6.60	1,410
5.10	210	5.50	410	5.90	720	6.30	1,100		
5.20	250	5.60	480	6.00	810	6.40	1,200		

[a] This table is applicable only for open-channel conditions. It is based on 2 discharge measurements made during 1906 and the form of the curve used during the first half of 1905, and is not well defined.

Rating tables for Fraser River at Granby, Colo.—Continued.

JUNE 13 TO NOVEMBER 30, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.30	50	4.90	190	5.50	520	6.10	1,040	6.70	1,700
4.40	65	5.00	230	5.60	590	6.20	1,150	6.80	1,810
4.50	80	5.10	275	5.70	670	6.30	1,260		
4.60	100	5.20	330	5.80	750	6.40	1,370		
4.70	125	5.30	385	5.90	840	6.50	1,480		
4.80	155	5.40	450	6.00	940	6.60	1,590		

[a] This table is applicable only for open-channel conditions. It is based on 3 discharge measurements made during 1906 and the form of previous curves, and is well defined above gage height 4.6 feet.

Monthly discharge of Fraser River at Granby, Colo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April (15–31)	550	146	314	9,960
May	1,000	140	568	34,900
June	1,860	630	1,040	61,900
July	630	172	357	22,000
August	230	125	152	9,350
September	210	80	112	6,660
October	155	100	110	6,760
November	100	50	70.9	4,220
The period				156,000

NOTE.—The above values are good. The discharge remains at about 50 second-feet throughout the winter, as the river is fed by springs.

WILLIAMS FORK DRAINAGE BASIN.

WILLIAMS FORK NEAR HOT SULPHUR SPRINGS, COLO.

Williams Fork rises in the Williams River Mountains in southeastern Grand County, flows in a general northwesterly direction, and unites with Grand River in the central part of Middle Park, Colorado.

The gaging station was established July 25, 1904. It is located at the wagon bridge on the ranch of F. A. Field, in T. 1 N., R. 79 W., about 9 miles west of Hot Sulphur Springs, 4 miles above the mouth of the stream, and below all the tributaries. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 89, where are given also references to publications that contain data for previous years.

Discharge measurements of Williams Fork near Hot Sulphur Springs, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 16	M. C. Hinderlider	28	56	3.47	99
May 19	do	59	118	4.28	520
June 20	T. E. Brick	54	118	4.70	750
July 1	do	53	120	4.50	591
September 9	A. A. Weiland	44	74	3.39	76
December 14[a]	R. I. Meeker	26	46	3.22	56

[a] Surface ice along s des of stream.

Daily gage height, in feet, of Williams Fork near Hot Sulphur Springs, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.54	4.34	4.48	3.76	3.45	3.51	3.45	3.34
2	.....	3.59	4.34	4.45	3.80	3.60	3.50	3.48	3.31
3	.....	3.67	4.33	4.49	3.72	3.60	3.50	3.46	3.32
4	.....	3.76	4.32	4.34	3.70	3.47	3.56	3.40	3.34
5	.....	3.91	4.40	4.30	3.68	3.46	3.50	3.39	3.31
6	.....	3.96	4.55	4.30	3.72	3.46	3.50	3.42	3.29
7	.....	3.94	4.36	4.26	3.72	3.46	3.50	3.42	3.26
8	.....	4.01	4.30	4.30	3.69	3.46	3.50	3.42	3.22
9	3.34	4.05	4.34	4.22	3.64	3.40	3.48	3.26	3.19
10	3.45	4.12	4.48	4.20	3.53	3.40	3.48	3.26	3.25
11	3.55	4.15	4.65	4.22	3.51	3.38	3.47	3.38	3.26
12	3.49	4.14	4.82	4.30	3.51	3.35	3.46	3.28	3.25
13	3.35	4.09	5.02	4.25	3.50	3.35	3.42	3.37	3.24
14	3.23	3.98	5.12	4.22	3.52	3.30	3.40	3.36	3.20
15	3.44	3.99	5.18	4.24	3.51	3.32	3.44	3.38	3.19
16	3.59	4.16	5.12	4.16	3.49	3.68	3.46	3.34	3.16
17	3.62	4.22	5.05	4.14	3.48	3.60	3.46	3.34	.....
18	3.62	4.26	4.31	4.10	3.48	3.54	3.44	3.24	.....
19	3.61	4.31	4.27	4.09	3.48	3.56	3.41	3.18	.....
20	3.70	4.38	4.72	4.02	3.46	3.56	3.48	3.18	.....
21	3.68	4.36	4.69	4.00	3.62	3.56	3.36	3.28	.....
22	3.95	4.44	4.71	3.98	3.78	3.56	3.29	3.31	.....
23	4.04	4.48	4.70	3.94	3.62	3.54	3.30	3.28	.....
24	3.89	4.36	4.55	4.00	3.50	3.52	3.48	3.34	.....
25	3.72	4.36	4.50	3.92	3.50	3.50	3.52	3.29	.....
26	3.68	4.32	4.50	3.86	3.48	3.72	3.48	3.24	.....
27	3.62	4.32	4.54	3.84	3.48	3.65	3.48	3.18	.....
28	3.50	4.38	4.52	3.82	3.48	3.58	3.48	3.22	.....
29	3.60	4.52	4.49	3.79	3.47	3.57	3.48	3.32	.....
30	3.62	4.40	4.46	3.78	3.46	3.55	3.46	3.29	.....
31	.....	4.32	.....	3.76	3.45	.....	3.47	.....	.....

NOTE.—Ice conditions after Dec. 16.

Rating table for Williams Fork near Hot Sulphur Springs, Colo., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.10	25	3.60	130	4.10	335	4.60	650	5.10	1,080
3.20	40	3.70	160	4.20	390	4.70	730	5.20	1,170
3.30	60	3.80	200	4.30	450	4.80	810		
3.40	80	3.90	240	4.40	510	4.90	900		
3.50	105	4.00	285	4.50	580	5.00	990		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906 and is well defined.

Monthly discharge of Williams Fork near Hot Sulphur Springs, Colo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April (9–30)	305	46	139	6,070
May	594	115	374	23,000
June	1,150	432	661	39,300
July	566	184	355	21,800
August	200	92	126	7,750
September	168	60	107	6,370
October	120	58	95.5	5,870
November	100	37	65.6	3,900
December (1–16)	68	34	51.8	1,640
The period				116,000

NOTE.—Values are rated as follows, April to October, excellent; November and December, good.

BLUE RIVER DRAINAGE BASIN.

BLUE RIVER NEAR KREMMLING, COLO.

Blue River rises among the peaks of the Continental Divide in the extreme southeastern part of Summit County, Colo., and flows in a general northwesterly direction until it joins Grand River above the point where the latter stream enters Gore Canyon.

The gaging station was established July 21, 1904. It is located at the State highway bridge on the road between Kremmling and Dillon, Colo., 17 miles from the former and 26 miles from the latter, in T. 2 S., R. 80 W., and is below all tributaries of any importance. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 96, where are given also references to publications that contain data for previous years.

Discharge measurements of Blue River near Kremmling, in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 27 [a]	W. A. Lamb	108	151	2.50	346
May 9	do	131	210	2.90	589
May 26	do	147	371	3.50	1,860
June 7	do	166	541	[b] 4.00	3,280
June 28	do	151	382	3.45	1,730
July 23	do	139	236	3.12	702
August 12	do	125	212	2.82	572
August 26	do	118	182	2.58	420
September 6	do	115	182	2.59	422
September 13	do	110	151	2.45	284
September 28	do	99	125	2.30	211
1906.					
April 15	M. C. Hinderlider	92	121	2.25	193
May 20	do	167	428	3.75	2,540
June 21	T. E. Brick	149	381	3.70	2,490
July 2	do	146	354	3.58	1,990
September 8	A. A. Weiland	115	169	2.51	370
December 13 [c]	R. I. Meeker	48	71	2.32	159

[a] Channel partly filled with ice along sides and piers.
[b] Gage height corrected to agree with reading of staff gage.
[c] Ice along banks and at places in midstream; some slush ice running.

Daily gage height, in feet, of Blue River near Kremmling, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.55	2.48	3.50	3.55	3.02	2.60	2.78	2.38	2.28
2	2.25	2.52	3.50	3.45	3.05	2.78	2.72	2.50	2.35
3	2.25	2.55	3.55	3.40	2.95	2.80	2.72	2.45	2.40
4	2.20	2.62	3.45	3.35	2.95	2.70	2.68	2.40	2.40
5	2.35	2.92	3.55	3.35	2.95	2.65	2.75	2.42	2.35
6	2.75	3.02	3.85	3.30	2.98	2.52	2.65	2.38	2.38
7	2.95	3.05	3.55	3.30	2.90	2.55	2.65	2.35	2.30
8	2.55	3.08	3.35	3.35	2.90	2.52	2.60	2.35	2.32
9	2.65	3.35	3.45	3.30	2.82	2.55	2.65	2.35	2.30
10	2.45	3.65	3.80	3.38	2.80	2.60	2.60	2.35	2.32
11	2.45	3.78	4.15	3.40	2.80	2.52	2.62	2.35	2.30
12	2.45	3.75	4.45	3.42	2.80	2.52	2.52	2.28	2.30
13	2.25	3.40	4.60	3.42	2.82	2.58	2.50	2.32	2.30
14	2.10	3.05	4.75	3.42	2.90	2.55	2.50	2.32	2.28
15	2.20	3.18	4.60	3.35	2.85	2.60	2.45	2.35	2.12

Daily gage height, in feet, of Blue River near Kremmling, Colo., for 1906—Continued.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	2.50	3.75	4.60	3.35	2.80	2.85	2.48	2.32	2.10
17	2.50	3.50	4.45	3.35	2.75	2.80	2.48	2.30	2.15
18	2.60	3.50	3.75	3.32	2.78	2.70	2.48	2.20	2.22
19	2.55	3.68	3.65	3.25	2.78	2.70	2.45	2.22	2.25
20	2.62	4.05	3.50	3.22	2.80	2.70	2.48	2.10	2.30
21	2.75	3.75	3.60	3.20	2.90	2.72	2.40	2.25	2.38
22	2.88	3.80	3.60	3.15	3.05	2.78	2.40	2.30	2.38
23	3.02	3.85	3.70	3.15	2.90	2.70	2.40	2.30	2.42
24	3.00	3.60	3.45	3.22	2.80	2.62	2.40	2.35	2.45
25	2.75	3.60	3.40	3.22	2.75	2.62	2.42	2.30	2.45
26	2.75	3.45	3.38	3.18	2.75	3.20	2.42	2.25	2.38
27	2.60	3.45	3.40	3.10	2.62	3.05	2.50	2.20	2.35
28	2.50	3.55	3.48	3.15	2.52	2.95	2.50	2.35	2.28
29	2.60	3.80	3.38	3.10	2.52	2.85	2.42	2.25	2.30
30	2.50	3.55	3.48	3.05	2.50	2.80	2.38	2.32	2.28
31	.....	3.45	.....	2.98	2.55	.....	2.38	.....	2.32

Rating table for Blue River near Kremmling, Colo., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.70	20	2.40	260	3.10	990	3.80	2,690	4.50	5,050
1.80	30	2.50	330	3.20	1,160	3.90	2,990	4.60	5,430
1.90	45	2.60	410	3.30	1,360	4.00	3,300	4.70	5,820
2.00	65	2.70	500	3.40	1,590	4.10	3,630	4.80	6,220
2.10	95	2.80	600	3.50	1,850	4.20	3,970		
2.20	140	2.90	710	3.60	2,120	4.30	4,320		
2.30	195	3.00	840	3.70	2,400	4.40	4,680		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906, and is well defined between gage heights 2.3 feet and 4 feet.

Monthly discharge of Blue River near Kremmling, Colo., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
April (5–30)	600	95	242	12,500
May	2,540	410	1,290	79,300
June	4,860	1,590	2,910	173,000
July	1,590	600	800	49,200
August	655	260	398	24,500
September	500	140	230	13,700
October	195	95	158	9,720
November	195	65	127	7,560
December (1–9)	195	20	89.4	1,600
The period	.....	.....	.....	371,000
1906.				
April	870	95	400	23,800
May	3,460	316	1,730	106,000
June	6,020	1,480	2,690	160,000
July	1,980	814	1,350	83,000
August	915	330	630	38,700
September	1,160	346	519	30,900
October	580	247	359	22,100
November	330	95	210	12,500
December	295	95	207	12,700
The period	.....	.....	.....	490,000

NOTE.—Values are rated as follows: April, and August to November, 1905; April, October and November, 1906, fair. July, 1905, August and September, 1906, good. May and June, 1905, and May to July, 1906, excellent. December of both years, approximate.

EAGLE RIVER DRAINAGE BASIN.

EAGLE RIVER NEAR EAGLE, COLO.

Eagle River, an important headwater tributary of Grand River, rises among the high peaks of the Continental Divide, in Eagle County, Colo., immediately opposite the headwaters of Arkansas River, flows a little north of west for about 20 miles, and then in a general westerly direction to its junction with the Grand. It is a very rapid stream throughout its entire course, flowing alternately through canyons and narrow, terraced valleys.

The drainage area is almost wholly in Eagle County. The upper third of the basin is entirely mountainous, the general elevation at the crest of the divide being 12,000 feet above sea level, with peaks over 14,000 feet in altitude. In this part of its course the river descends in falls and cascades, the average slope above the mouth of Roche Moutonnée Creek being 150 feet per mile. The rocks are about equally divided between metamorphic granites and sedimentary formations. The forest cover is excellent, soil is shallow, and erosion is small. The annual precipitation, which is mostly in the form of snow, varies from 20 to 30 inches. This portion of the basin furnishes 90 per cent of the discharge of the stream.

The lower two-thirds of the basin is also mountainous but is less accentuated, the elevations varying from 7,000 to 11,000 feet. The rocks are largely sedimentary, erosion is greater, and the forest cover is meager. The precipitation is approximately 20 inches.

The principal tributaries of the Eagle are Gore, Roche Moutonnée, Gypsum, and Brush creeks.

Below Wolcott a few small ditches divert water for irrigation of the narrow first bench lands, and there is enough irrigation in Gypsum and Brush Creek valleys to divert the entire flow during the latter part of the season.

The gaging station was established March 12, 1905. It is located at Rule's private road bridge, in T. 5 S., R. 85 W., 2½ miles below Eagle, Colo. The chief object of the station is the collection of power data. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 98.

Discharge measurements of Eagle River near Eagle, Colo., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 18	R. I. Meeker	40	119	0.80	187
May 12	do	50	207	2.20	735
July 10	do	45	233	2.40	794
August 15	do	45	202	1.55	406
September 25	do	60	162	1.20	198
1906.					
April 5	R. I. Meeker	60	173	.95	251
May 3	do	95	226	2.15	685
May 28	do	96	411	4.40	2,650
June 16	do	96	548	5.40	4,960
July 14	T. E. Brick	66	345	3.60	1,730
November 23	R. I. Meeker	65	126	.90	203

NOTE.—These measurements were made at different sections.

Daily gage height, in feet, of Eagle River near Eagle, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.25	1.85	3.9	3.9	2.2	1.3	1.85	1.3	1.15
2	1.05	1.95	4.15	3.5	2.55	1.55	1.8	1.45	1.0
3	1.0	2.15	3.95	3.45	2.2	1.8	1.85	1.4	1.1
4	0.95	2.25	3.85	3.2	2.25	1.85	1.85	1.5	1.1
5	1.0	2.7	4.1	3.2	2.05	1.6	1.8	1.5	1.0
6	1.25	2.95	4.6	3.2	2.0	1.6	1.8	1.5	1.0
7	1.55	2.95	3.9	3.35	2.0	1.5	1.7	1.5	1.0
8	1.3	3.15	3.9	3.15	1.85	1.5	1.6	1.5	1.0
9	1.2	3.55	3.8	3.3	1.8	1.5	1.55	1.45	1.1
10	1.25	3.9	4.6	3.35	1.85	1.5	1.5	1.4	1.1
11	1.35	3.95	5.05	3.25	1.75	1.5	1.5	1.4	1.0
12	1.4	3.95	5.25	3.3	1.75	1.45	1.5	1.35	1.0
13	1.3	3.55	5.7	3.25	1.8	1.4	1.5	1.3	1.0
14	1.25	3.4	5.3	3.55	1.8	1.4	1.4	1.3	0.95
15	1.35	3.45	5.2	3.45	1.85	1.8	1.4	1.3	0.75
16	1.4	3.9	5.15	3.15	1.85	1.85	1.4	1.4	0.8
17	1.75	4.15	5.1	3.05	1.85	1.85	1.3	1.3	0.8
18	1.9	4.5	4.45	2.95	1.8	1.8	1.3	1.3	0.9
19	1.8	4.75	4.25	2.85	1.8	1.8	1.3	1.3	0.9
20	1.95	4.9	4.2	2.85	1.75	1.8	1.4	1.2	0.9
21	2.25	4.7	4.15	2.8	1.8	1.8	1.4	1.1	1.0
22	2.55	4.8	4.1	2.2	1.9	1.8	1.4	1.0	1.0
23	2.9	4.8	4.1	2.0	1.95	1.8	1.35	0.9	1.0
24	2.9	4.4	3.9	2.55	1.85	1.8	1.3	0.9	1.0
25	2.55	4.1	3.65	2.75	1.85	1.8	1.4	0.9	1.0
26	2.45	3.85	3.75	2.55	1.55	2.1	1.45	0.9	1.0
27	2.25	3.8	3.85	2.5	1.45	2.3	1.4	0.95	0.9
28	2.0	4.3	3.85	2.4	1.45	2.0	1.4	1.0	0.9
29	1.9	4.8	3.7	2.3	1.35	1.9	1.4	1.1	0.9
30	1.95	4.1	3.7	2.25	1.3	1.8	1.4	1.1	0.9
31	.....	3.9	.....	2.2	1.3	.....	1.35	.....	0.9

Rating table for Eagle River near Eagle, Colo., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.60	145	1.50	375	2.40	820	3.30	1,465	4.40	2,720
.70	163	1.60	412	2.50	880	3.40	1,550	4.60	3,040
.80	183	1.70	452	2.60	945	3.50	1,640	4.80	3,430
.90	205	1.80	498	2.70	1,015	3.60	1,730	5.00	3,860
1.00	230	1.90	544	2.80	1,085	3.70	1,830	5.20	4,360
1.10	255	2.00	591	2.90	1,155	3.80	1,930	5.40	4,880
1.20	281	2.10	644	3.00	1,230	3.90	2,040	5.60	5,440
1.30	310	2.20	700	3.10	1,305	4.00	2,160	5.80	6,040
1.40	341	2.30	760	3.20	1,385	4.20	2,420	6.00	6,600

NOTE.—The above table is applicable only for open-channel conditions. It is based on 11 discharge measurements made during 1905–6 and is well defined between gage heights 0.8 feet and 5.4 feet.

Monthly discharge of Eagle River near Eagle, Colo., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
March (19-31)	183	154	167	4,310
April	790	154	301	17,900
May	2,870	591	1,470	90,400
June	6,040	1,550	3,160	188,000
July	1,420	432	697	42,900
August	475	218	348	21,400
September	358	218	273	16,200
October	268	205	228	14,000
November	230	183	205	12,200
December	218	163	177	10,900
The period	.....	.....	.....	418,000

Monthly discharge of Eagle River near Eagle, Colo., for 1905–6—Continued.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1906.				
April	1,160	218	499	29,700
May	3,640	521	2,050	126,000
June	5,740	1,780	2,750	164,000
July	2,040	591	1,230	75,600
August	912	310	518	31,900
September	760	310	467	27,800
October	521	310	381	23,400
November	375	205	300	17,900
December	268	173	223	13,700
The period				510,000

NOTE.—Values are rated as follows: March and December, 1905, good; remainder of 1905 and 1906, excellent.

ROARING FORK DRAINAGE BASIN.

ROARING FORK AT GLENWOOD SPRINGS, COLO.

This station was established April 6, 1906. It is located at a single-span wooden highway bridge about 500 feet above the mouth of Roaring Fork in the city of Glenwood Springs.

The channel is straight; the right bank is low and overflows at extreme high water, the left is high. The bed of the stream is rough and is composed of cobblestones and bowlders. There is but one channel at all stages and the current is swift.

Discharge measurements are made from the downstream side of the bridge. The initial point for soundings is at the right abutment.

A chain gage, which was read during 1906 by Mrs. C. S. Linsley, is attached to the downstream hand rail; length of chain, 20.44 feet. The bench mark is a cross cut in the upper surface of the first stone below the capstone of the east masonry abutment, upstream side; elevation, 12.94 feet above the datum of the gage.

Discharge measurements of Roaring Fork at Glenwood Springs, Colo., in 1906.

Date	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 8	R. I. Meeker	150	208	1.60	707
May 4	do	155	364	2.60	1,790
May 28	do	167	693	4.58	5,210
June 18	do	171	932	6.00	8,180
June 19	do	170	834	5.50	6,970
July 15	T. E. Brick	163	662	4.35	4,950
November 21	R. I. Meeker	120	163	1.54	465

Daily gage height, in feet, of Roaring Fork at Glenwood Springs, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.18	4.50	4.90	3.05	1.98	2.35	1.85	1.55
2	.....	2.20	4.65	4.98	3.20	2.15	2.32	1.90	1.55
3	.....	2.30	4.55	4.78	3.00	2.22	2.25	1.95	1.52
4	.....	2.58	4.32	4.50	2.88	2.12	2.32	1.80	1.60
5	.....	3.00	4.80	4.15	2.80	2.10	2.28	1.80	1.60
6	1.65	3.30	5.30	4.05	2.80	2.05	2.20	1.82	1.58
7	1.70	3.35	4.70	4.05	2.70	2.02	2.25	1.80	1.48
8	1.55	3.60	4.48	3.95	2.70	2.00	2.22	1.80	1.50
9	1.58	3.98	4.75	3.95	2.62	2.00	2.20	1.80	1.58
10	1.70	4.12	5.68	4.10	2.52	1.88	2.18	1.80	1.52
11	1.85	4.28	6.15	4.15	2.50	1.95	2.12	1.80	1.50
12	1.75	4.35	6.65	4.10	2.42	1.88	2.10	1.75	1.48
13	1.58	3.95	7.45	4.25	2.52	1.88	2.00	1.70	1.48
14	1.58	3.55	7.45	4.60	2.50	1.90	2.00	1.70	1.45
15	1.65	3.55	7.25	4.48	2.42	2.30	1.95	1.70	1.40
16	1.88	4.10	7.28	4.15	2.48	2.45	1.90	1.70	1.15
17	2.08	4.42	7.35	4.00	2.58	2.32	1.90	1.70	1.22
18	2.15	4.65	5.75	3.90	2.55	2.25	1.80	1.60	1.30
19	2.08	4.90	5.65	3.78	2.50	2.20	1.85	1.50	1.45
20	2.20	5.35	5.50	3.78	2.48	2.20	1.88	1.40	1.55
21	2.68	5.10	5.35	3.70	2.48	2.22	1.95	1.50	1.58
22	2.92	5.40	5.20	3.65	2.48	2.22	1.90	1.65	1.42
23	3.08	5.35	5.30	3.60	2.50	2.20	1.90	1.65	1.42
24	3.10	4.85	4.95	3.58	2.42	2.22	1.80	1.62	1.42
25	2.85	4.30	4.70	3.60	2.28	2.25	1.85	1.60	1.40
26	2.70	4.08	4.78	3.50	2.20	2.45	1.92	1.52	1.42
27	2.48	3.85	4.85	3.38	2.20	2.72	1.85	1.48	1.60
28	2.38	4.52	4.75	3.25	2.10	2.62	1.85	1.60	1.42
29	2.32	5.10	4.38	3.15	2.00	2.48	1.85	1.60	1.45
30	2.32	4.48	4.60	3.00	2.05	2.42	1.85	1.58	1.40
31	.....	4.40	.....	2.95	2.05	.....	1.80	.....	1.32

Rating tables for Roaring Fork at Glenwood Springs, Colo.

APRIL 6 TO MAY 8, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.50	630	2.00	1,070	2.50	1,670	3.00	2,380	3.50	3,180
1.60	710	2.10	1,180	2.60	1,800	3.10	2,530	3.60	3,350
1.70	790	2.20	1,300	2.70	1,940	3.20	2,690		
1.80	880	2.30	1,420	2.80	2,080	3.30	2,850		
1.90	970	2.40	1,540	2.90	2,230	3.40	3,010		

MAY 9 TO DECEMBER 31, 1906.[b]

1.10	200	2.00	910	2.90	2,140	3.80	3,720	5.40	6,940
1.20	250	2.10	1,025	3.00	2,300	3.90	3,910	5.60	7,360
1.30	310	2.20	1,145	3.10	2,470	4.00	4,100	5.80	7,780
1.40	375	2.30	1,275	3.20	2,640	4.20	4.500	6.00	8,200
1.50	445	2.40	1,410	3.30	2,810	4.40	4,900	6.20	8,640
1.60	520	2.50	1,550	3.40	2,990	4.60	5,300	6.40	9,080
1.70	605	2.60	1,690	3.50	3,170	4.80	5,700	6.60	9,520
1.80	700	2.70	1,840	3.60	3,350	5.00	6,100	6.80	9,960
1.90	805	2.80	1,990	3.70	3,530	5.20	6,520	7.00	10,400

[a] This table is applicable only for open-channnel conditions. It is based on 2 discharge measurements made during 1906 and is probably fairly accurate.

[b] This table is applicable only for open-channel conditions. It is based on 5 discharge measurements made during 1906 and is well defined.

Monthly discharge of Roaring Fork at Glenwood Springs, Colo., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April (6–30)	2,530	670	1,310	65,000
May	6,940	1,280	4,290	264,000
June	11,400	4,740	7,060	420,000
July	6,060	2,220	4,000	246,000
August	2,640	910	1,590	97,800
September	1,870	784	1,150	68,400
October	1,340	700	943	58,000
November	858	375	604	35,900
December	520	225	421	25,900
The period				1,300,000

NOTE.—The above values are good.

GUNNISON RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Gunnison River is formed in Gunnison County, Colo., by the union of East and Taylor rivers, two streams that have their origin among the snow-covered peaks and on the slopes of the Continental Divide in the northeastern part of the county, descend through narrow mountain valleys, and unite about 12 miles above Gunnison. From the junction of these rivers the Gunnison flows west and southwest to the point where it enters Grand River at Grand Junction, in the central part of Mesa County, Colo.

The upper course of the river lies through a broad, mountainous valley, but near the mouth of Lake Fork the valley narrows and the river enters Black Canyon of the Gunnison, through which it winds in a tortuous course for 56 miles between granite walls that rise precipitously 3,000 feet above the water's edge. A short distance below the mouth of North Fork, the largest tributary of the river, the canyon walls break abruptly, and the valley is broad and fertile. Below Delta the river enters another narrow canyon, with walls averaging 800 feet in height, and this continues irregularly to Grand Junction, a few tracts of narrow bottom land lying between the channel and the canyon walls.

As an aid to description the basin may be divided into an upper mountainous area and a lower plateau area, the two being divided roughly by a north-south line drawn through the town of Hotchkiss.

The soil of the lower valleys is chiefly adobe, and the higher mesas have large content of gravel and sand. Groves of quaking aspen, interspersed with large, open grazing plots, cover broad areas of this plateau region. Forests of pine and aspen occur on the top of the Grand Mesa, with piñon pines and cedars along the foothills. In the valleys chico and sagebrush form the controlling vegetation, except along the streams, which are bordered to some extent by cottonwood, willow, and undergrowth.

The chief tributaries of the Gunnison are Ohio, Tomichi, Lake Fork, and Cimarron creeks and Smith, North Fork, and Uncompahgre rivers, North Fork being the largest.

North Fork rises in the Huntsman Hills, 20 miles south of Glenwood Springs, flows in a general south and southwesterly course, and unites with the Gunnison about 8 miles west of Hotchkiss. The drainage area is highly mountainous, except for a small portion which lies below Paonia, extreme points reaching an altitude of 13,000 feet. The mesa lands at the lower end of the valley stand 5,500 feet above sea level. The higher peaks are formed of granitic rocks, but lower down sedimentary formations occupy at least 80 per cent of the area of the basin. The mountains are forested and the mesa lands are covered with sagebrush. All the tillable lands of the North Fork and its tributaries have been brought under cultivation, and irrigation is practiced to such an extent that the entire flow is needed for existing systems.

Uncompahgre River, the principal tributary of the Gunnison from the south, rises among the snowy peaks of the highly serrated Uncompahgre Mountains and flows a little west of north to its junction with the Gunnison at Delta. The basin embraces a mountainous, plateau, and valley area of 1,130 square miles, oblong in shape, the width increasing slightly at the lower end. The mountain area occupies but a small part of the basin, but contributes the perennial waters of the stream. The plateau area is greatest in extent and borders the valley on both sides, the larger Uncompahgre Plateau lying to the southwest. Escarpments are conspicuous features of this plateau. The relief features are terraced mesas flanked by shale buttes and ridges, trenched by deep, narrow canyons. Uncompahgre Valley proper begins at a point near Eldredge siding, on the Denver and Rio Grande Railroad.

The other tributaries of the Gunnison need not here be described. Ohio, Tomichi, Lake Fork, and Cimarron creeks are perennial streams, but almost their entire volume is diverted for irrigation during the growing season, so that very little of their water reaches the Gunnison except at times of heavy storms or during spring floods.

Precipitation records for the Gunnison basin are meager. Those which exist show a range from 9 inches in the plateau region to about 25 inches in the mountains.

The natural flow of the Uncompahgre and North Fork rivers is diverted for irrigation along their respective valleys, and the Gunnison tunnel will divert water from the mountainous area and transmit it to Uncompahgre Valley, which has been an irrigated district since the early eighties.

GUNNISON RIVER AT EAST PORTAL OF GUNNISON TUNNEL, COLO.

This station was established April 1, 1905, and replaces the Cimarron station, 12 miles above. It is located about 100 yards above the portal of the tunnel and is in T. 49 N., R. 7 W., 21 miles by wagon road from Montrose. The object of the station is to determine the volume of flow of the river at this point, as 1,300 second-feet will be diverted by the Gunnison tunnel when it is completed. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 108.

Discharge measurements of Gunnison River at east portal of Gunnison tunnel, Colo., in 1905–6.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1905.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 1	O. McDermith		1,300	9.05	4,530
May 27	do		1,790	11.80	8,540
June 3	do		2,100	12.80	11,200
June 17	do		1,760	11.25	7,100
June 20	do		1,650	10.60	6,690
June 29	do		1,410	9.25	4,180
July 6	do		1,170	7.60	2,520
July 13	do		1,050	6.85	1,700
August 3	do		1,090	7.12	2,040
August 11	do		917	6.00	1,020
August 19	do		860	5.60	763
August 28	do		846	5.50	689
September 13	do		806	5.24	575
1906.					
April 9	McDermith and Overstreet	149	995	6.39	1,480
April 17	do	153	1,130	7.27	2,240
April 19	do	155	1,170	7.52	2,510
April 21	do	159	1,290	8.14	2,960
May 8	C. Z. Overstreet	174	1,600	10.10	5,770
May 9	do	181	1,700	10.60	6,520
May 11	do	190	1,830	11.30	7,680
May 21	do	202	2,000	12.30	9,810
June 12	O. McDermith	213	2,260	13.70	12,800
June 14	do	216	2,400	14.20	15,000
June 18	C. Z. Overstreet	206	2,090	12.80	10,200
June 23	do	192	1,850	11.30	7,670
July 7	do	164	1,410	9.00	3,750
July 20	do	160	1,290	8.30	2,780
August 13	do	149	1,020	6.80	1,300
September 7	E. F. Kriegsman	146	983	6.15	808
September 24	do	147	962	6.32	982
September 27	do	152	1,110	7.29	1,770

Daily gage height, in feet, of Gunnison River at east portal of Gunnison tunnel, Colo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.3	6.3	6.2	6.4	7.7	11.2	10.1	7.7	6.35	6.8	6.2	6.2
2	6.3	6.3	6.2	6.45	7.7	11.1	10.0	7.7	6.4	6.8	6.2	6.1
3	6.3	6.3	6.3	6.5	7.7	11.1	9.9	7.6	6.55	6.8	6.2	6.0
4	6.3	6.3	6.3	6.55	8.3	11.0	9.75	7.6	6.65	6.7	6.2	6.0
5	6.3	6.3	6.3	6.65	9.0	11.1	9.45	7.35	6.6	6.7	6.2	6.0
6	6.2	6.3	6.3	6.65	9.3	11.5	9.15	7.3	6.4	6.7	6.2	5.9
7	6.2	6.3	6.2	6.65	9.7	11.7	9.0	7.2	6.15	6.55	6.2	.....
8	6.2	6.3	6.2	6.6	10.05	11.8	9.0	7.1	6.15	6.4	6.2	.....
9	6.2	6.3	6.2	6.55	10.45	11.8	9.0	7.0	6.1	6.3	6.1	.....
10	6.2	6.3	6.2	6.7	10.9	12.3	9.1	6.9	6.1	6.3	6.1	.....
11	6.2	6.3	6.2	6.9	11.3	13.05	9.15	6.8	6.1	6.2	6.0	.....
12	6.2	6.3	6.2	6.8	10.95	13.8	9.2	6.8	6.0	6.2	5.9	.....
13	6.2	6.3	6.2	6.65	10.6	14.3	9.2	6.8	5.95	6.2	5.8	.....
14	6.2	6.3	6.2	6.45	10.15	14.2	9.2	6.8	5.9	6.3	5.8	.....
15	6.2	6.3	6.2	6.55	10.1	13.9	9.1	6.8	6.25	6.2	5.9	.....

Daily gage height, in feet, of Gunnison River at east portal of Gunnison tunnel, Colo., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	6.2	6.3	6.2	6.8	10.5	13.8	8.95	6.8	6.65	6.2	5.9	.....
17	6.2	6.3	6.2	7.25	11.0	13.5	8.75	6.8	6.85	6.1	5.85	.....
18	6.2	6.3	6.2	7.6	11.4	12.7	8.6	6.8	6.75	6.0	5.7	.....
19	6.2	6.3	6.2	7.6	11.7	12.0	8.45	6.8	6.55	5.9	5.4	.....
20	6.2	6.3	6.2	7.75	12.0	11.4	8.3	6.95	6.35	6.1	5.4	.....
21	6.2	6.2	6.2	8.1	12.3	11.4	8.3	7.15	6.3	6.0	5.5	.....
22	6.2	6.2	6.2	8.65	12.4	11.4	8.3	7.2	6.3	6.0	6.0	.....
23	6.2	6.2	6.3	9.15	12.2	11.15	8.3	7.2	6.3	5.9	6.0	.....
24	6.2	6.2	6.4	9.3	11.7	10.6	8.2	7.0	6.3	5.8	6.0	.....
25	6.2	6.2	6.5	8.75	10.9	10.3	8.2	6.8	6.4	5.9	6.0	.....
26	6.3	6.2	6.5	8.35	10.75	10.3	8.2	6.65	6.45	6.0	5.9	.....
27	6.3	6.2	6.4	8.05	10.7	10.3	8.1	6.5	7.3	6.15	5.9	.....
28	6.3	6.2	6.4	7.85	11.1	10.3	8.1	6.4	7.4	6.2	6.25	.....
29	6.3	.....	6.3	7.7	11.7	10.2	8.0	6.35	7.0	6.2	6.3	.....
30	6.3	.....	6.3	7.7	11.4	10.2	8.0	6.3	6.9	6.1	6.3	.....
31	6.3	.....	6.3	.....	11.0	.....	7.85	6.3	.....	6.1	.....	.....

NOTE.—The following ice conditions prevailed during 1906: River frozen January 1 to March 24; March 21 to 24, ice rotten; March 25, ice coming down river; March 26, ice nearly gone; March 27, ice entirely gone above and in front of engineer's camp; November 18 and 19, ice coming down and freezing to banks; November 20, channel partly frozen over; November 22, ice jam below gage; November 25 to December 3 river frozen over at gage, and about 200 feet above and below; December 6, channel open. Thickness of ice in feet: January 1–3, 2.0; January 4, 2.1; January 5–8, 2.2; January 9–20, 2.3; January 21 to February 2, 2.4; February 3 to 6, 2.3; February 7–9, 2.2; February 10–11, 2.1; February 12–16, 2.0; February 17–20, 1.8; February 21 to March 6, 1.7; March 7–16, 1.5; March 17, 1.4; March 18–19, 1.3; March 20, 1.2; March 21–24 (rotten), 1.0.

Rating tables for Gunnison River at east portal of Gunnison tunnel, Colo.

APRIL 9, 1905, TO JUNE 10, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
5.00	400	6.00	1,025	7.00	1,900	8.00	2,920	10.00	5,540
5.10	450	6.10	1,105	7.10	1,995	8.20	3,140	10.20	5,850
5.20	505	6.20	1,185	7.20	2,090	8.40	3,380	10.40	6,170
5.30	560	6.30	1,270	7.30	2,190	8.60	3,620	10.60	6,500
5.40	620	6.40	1,355	7.40	2,290	8.80	3,870	10.80	6,840
5.50	680	6.50	1,440	7.50	2,390	9.00	4,130	11.00	7,200
5.60	745	6.60	1,530	7.60	2,490	9.20	4,390	12.00	9,150
5.70	810	6.70	1,620	7.70	2,590	9.40	4,670	13.00	11,370
5.80	880	6.80	1,710	7.80	2,700	9.60	4,950	14.00	13,900
5.90	950	6.90	1,805	7.90	2,810	9.80	5,240	.....	.....

JUNE 11 TO DECEMBER 6, 1906.[b]

5.40	380	6.30	930	7.20	1,685	8.20	2,725	10.00	5,200
5.50	430	6.40	1,005	7.30	1,780	8.40	2,960	10.20	5,540
5.60	480	6.50	1,080	7.40	1,875	8.60	3,200	10.40	5,890
5.70	535	6.60	1,160	7.50	1,975	8.80	3,460	10.60	6,250
5.80	595	6.70	1,240	7.60	2,075	9.00	3,720	10.80	6,620
5.90	660	6.80	1,325	7.70	2,180	9.20	4,000	11.00	7,000
6.00	725	6.90	1,410	7.80	2,285	9.40	4,280	12.00	9,070
6.10	790	7.00	1,500	7.90	2,390	9.60	4,580	13.00	11,370
6.20	860	7.10	1,590	8.00	2,500	9.80	4,880	14.00	13,900

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made prior to June 10, 1906, and is well defined.

[b] This table is applicable only for open-channel conditions. It is based on discharge measurements made after June 10, 1906, and is well defined.

Monthly discharge of Gunnison River at east portal of Gunnison tunnel, Colo., for 1905–6.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1905.				
April 9–30	3,320	950	1,430	62,400
May	9,040	2,490	5,220	321,000
June	13,800	4,200	8,360	497,000
July	3,800	1,440	2,040	125,000
August	2,760	680	1,130	69,500
September	745	450	560	33,300
October	712	450	519	31,900
November	560	400	491	29,200
The period				1,170,000
1906.				
March 27–31	1,360	1,270	1,310	13,000
April	4,530	1,360	2,270	135,000
May	10,000	2,590	6,620	407,000
June	14,700	5,540	8,830	525,000
July	5,370	2,340	3,510	216,000
August	2,180	930	1,470	90,400
September	1,880	660	1,060	63,100
October	1,320	595	905	55,600
November 1–20	860	380	714	28,300
The period				1,530,000

NOTE.—The above values are excellent.

GUNNISON RIVER AT WHITEWATER, COLO.

This station was regularly established April 10, 1902, incomplete series of gage heights having been obtained during 1895, 1897, and 1901. It is located at the steel wagon bridge constructed by the State of Colorado at a point about one-half mile above the railroad station at Whitewater, on the Denver and Rio Grande Railroad. It was intended that this station should replace that formerly maintained on the Gunnison at Grand Junction, which was abandoned on account of conditions that rendered accurate gagings impossible. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 112, where are given also references to publications that contain data for previous years.

Discharge measurements of Gunnison River at Whitewater, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 12	R. I. Meeker	278	1,110	6.35	3,440
May 6	do	278	2,190	10.22	11,600
May 18	E. C. Murphy	277	2,710	11.85	16,900
May 30	R. I. Meeker	278	2,790	12.12	18,200
June 20	do	278	2,430	10.86	13,300
November 20	do	244	592	4.20	956

Daily gage height, in feet, of Gunnison River at Whitewater, Colo., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	5.12	7.50	11.40	8.35	6.10	4.50	5.50
2	5.22	7.45	11.50	8.55	6.00	5.00	5.35
3	5.12	7.80	11.55	8.45	6.35	5.00	5.30
4	4.97	8.20	11.25	8.25	6.15	4.85	5.20
5	5.17	9.20	11.20	8.10	5.95	4.75	5.20
6	5.32	9.90	11.60	7.80	5.80	4.70	5.15
7	5.97	10.30	11.60	7.75	5.75	4.55	5.10
8	6.27	10.45	11.15	7.70	5.60	4.50	5.10
9	6.02	11.05	11.00	7.60	5.50	4.50	5.00
10	5.62	11.45	11.45	7.45	5.35	4.40	4.90
11	6.12	11.80	12.00	7.35	5.05	4.40	4.80
12	6.42	12.05	12.50	7.40	5.00	4.35	4.75
13	6.07	11.65	12.95	7.30	5.00	4.25	4.70
14	5.72	11.40	13.10	7.30	5.00	4.20	4.70
15	5.95	10.80	12.90	7.45	5.05	4.65	4.70
16	6.35	11.20	12.65	7.30	5.00	5.35	4.70
17	7.05	11.45	12.45	7.05	5.10	5.45	4.70
18	7.25	11.75	12.10	6.85	5.10	5.30	4.65
19	7.60	12.25	11.10	6.90	5.10	5.05	4.65
20	7.55	12.80	10.80	6.75	5.05	5.00	4.70
21	8.10	13.05	10.60	6.60	5.05	4.75	4.90
22	8.75	13.00	10.45	6.30	5.25	4.85	5.00
23	9.35	12.80	10.15	6.30	5.45	5.00	4.85
24	9.90	12.65	9.90	6.20	5.35	5.00	4.80
25	9.55	12.55	9.55	6.40	5.15	4.95	4.70
26	8.75	11.60	8.90	6.35	4.95	5.10	4.75
27	8.15	10.80	8.70	6.30	4.90	5.30	4.85
28	7.75	11.45	8.65	6.35	4.75	5.95	5.00
29	8.05	12.05	8.55	6.30	4.65	5.65	5.00
30	7.90	11.95	8.35	6.30	4.55	5.55	4.96
31	.....	11.45	.....	6.25	4.50	.....	4.90

Rating table for Gunnison River at Whitewater, Colo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.20	1,050	5.20	1,970	6.20	3,190	7.40	5,040	9.40	9,390
4.30	1,130	5.30	2,075	6.30	3,330	7.60	5,400	9.60	9,900
4.40	1,210	5.40	2,185	6.40	3,480	7.80	5,790	9.80	10,420
4.50	1,290	5.50	2,295	6.50	3,630	8.00	6,190	10.00	10,970
4.60	1,380	5.60	2,415	6.60	3,780	8.20	6.605	11.00	13,980
4.70	1,470	5.70	2,535	6.70	3,930	8.40	7,025	12.00	17,430
4.80	1,560	5.80	2,665	6.80	4,080	8.60	7,460	13,00	21,460
4.90	1,660	5.90	2,795	6.90	4,230	8.80	7,915		
5.00	1,760	6.00	2,925	7.00	4,390	9.00	8,400		
5.10	1,865	6.10	3,055	7.20	4,710	9.20	8,890		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1902–1906 and is well defined.

Monthly discharge of Gunnison River at Whitewater, Colo., for 1906.

[Drainage area, 7,870 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum	Mean.		Sec. ft. per sq. mile.	Depth in inches.
April	10,700	1,730	4,590	273,000	0.583	0.65
May	21,700	5,130	14,800	910,000	1.88	2.17
June	21,900	6,920	14,400	857,000	1.83	2.04
July	7,350	3,190	4,710	290,000	.598	0.69
August	3,400	1,290	2,080	128,000	.264	0.30
September	2,860	1,050	1,680	100,000	.213	0.24
October	2,300	1,420	1,690	104,000	.215	0.25
The period	.....	.....	.....	2,660,000	.....	.....

NOTE.—Values are rated as follows: April to July, excellent; August to October, good.

NORTH FORK OF GUNNISON RIVER NEAR HOTCHKISS, COLO.

This station was established April 13, 1904, and discontinued March 31, 1906. It is located 4 miles below Hotchkiss, Colo., on the ranch of L. Gorsuch, and replaces the station maintained during 1903 at the highway bridge one-half mile east of Hotchkiss and abandoned because of unsatisfactory conditions. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 115, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of North Fork of Gunnison River near Hotchkiss, Colo., for 1906.

Day.	Jan.	Feb.	Mar.	Day.	Jan.	Feb.	Mar.
1	2.30	1.95	1.85	17	2.25	2.00	1.95
2	2.30	1.95	1.80	18	2.18	1.98	2.00
3	2.25	2.00	1.78	19	2.20	1.95	1.92
4	2.25	2.02	1.75	20	2.25	1.95	1.90
5	2.20	2.05	1.75	21	2.20	1.90	2.25
6	2.20	2.10	1.80	22	2.15	1.92	2.15
7	2.15	2.10	1.85	23	2.10	1.95	2.10
8	2.18	2.10	1.85	24	2.08	1.92	2.25
9	2.22	2.05	1.90	25	2.05	1.88	2.50
10	2.30	2.05	1.90	26	2.00	1.88	3.10
11	2.32	2.10	2.00	27	2.00	1.88	2.55
12	2.35	2.10	2.00	28	2.00	1.85	2.55
13	2.40	2.08	2.05	29	2.00	.....	2.50
14	2.40	2.02	2.28	30	2.00	.....	2.45
15	2.38	2.02	2.10	31	2.00	.....	2.58
16	2.32	2.02	2.00				

UNCOMPAHGRE RIVER NEAR COLONA, COLO.

This station was established April 9, 1904. It is located at the private road bridge of J. M. Duckett, in T. 47 N., R. 8 W., one-half mile above Eldredge siding on the Denver and Rio Grande Railroad and 3 miles above Colona, Colo. It is best reached by driving from Montrose. The station replaces one that was established August 10, 1903, at Kettle's bridge, 1 mile south of Colona, to take the place of the original station, which was located one-half mile northeast of Colona. Both of these stations were abandoned because of unsatisfactory conditions. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 120, where are given also references to publications that contain data for previous years.

Discharge measurements of Uncompahgre River near Colona, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 15	R. I. Meeker	45	60	1.42	188
May 8	do	47	112	2.38	653
June 1	do	47	121	2.48	792
June 22	do	47	191	.....	1,120

Daily gage height, in feet, of Uncompahgre River near Colona, Colo., for 1906.

Day.	Apr.	May.	June.	Day.	Apr.	May.	June.
1	.....	1.75	2.50	17	1.60	2.55	.....
2	.....	1.70	2.30	18	1.68	2.70	.....
3	.....	1.70	2.50	19	1.70	3.00	.....
4	.....	2.00	2.30	20	1.68	2.90	.....
5	.....	2.35	2.55	21	1.95	2.75	.....
6	.....	2.35	2.50	22	2.25	2.85	.....
7	.....	2.35	2.60	23	2.55	2.70	.....
8	.....	2.50	2.55	24	2.20	2.50	.....
9	.....	2.45	3.15	25	2.00	2.50	.....
10	.....	2.35	3.35	26	2.00	2.20	.....
11	.....	2.35	.....	27	1.90	2.50	.....
12	.....	2.55	.....	28	1.85	2.80	.....
13	.....	2.45	.....	29	1.85	2.70	.....
14	.....	2.20	.....	30	1.85	2.55	.....
15	1.42	2.25	.....	31	.....	2.35	.....
16	1.45	2.45	.....				

NOTE.—The gage was displaced, the bench-mark destroyed, and the channel changed, about June 10, records after that date are of no value.

UNCOMPAHGRE RIVER AT MONTROSE, COLO.

This station was established April 22, 1903. It is located at the iron highway bridge west of Montrose and one-fourth mile west of the Denver and Rio Grande Railroad near Haskell Park. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 122, where are given also references to publications that contain data for previous years.

Discharge measurements of Uncompahgre River at Montrose, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 14	R. I. Meeker	31	33	1.85	47
May 7	do	35	82	3.32	380
June 1	do	40	87	3.50	414
June 22	do	42	106	3.89	542

Daily gage height, in feet, of Uncompahgre River at Montrose, Colo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.00	2.15	2.08	2.15	2.48	3.50	3.60	2.70	1.68	2.35	2.20	2.48
2	2.00	2.08	1.98	1.95	2.45	3.62	3.40	2.85	1.80	2.20	2.25	2.50
3	2.25	2.12	1.75	1.92	2.45	3.30	3.05	2.70	1.70	2.25	2.05	2.50
4	2.05	2.08	1.92	1.95	2.85	3.05	2.88	2.60	1.62	2.12	2.15	2.60
5	2.30	2.10	1.92	2.10	3.15	3.62	2.75	2.55	1.55	2.15	1.90	2.55
6	2.28	2.10	1.88	2.00	3.30	3.58	2.58	2.35	1.50	2.08	1.98	2.45
7	2.08	2.08	1.90	2.35	3.45	3.60	2.45	2.20	1.52	2.02	1.95	2.40
8	2.22	2.06	1.88	2.18	3.62	3.58	2.78	2.10	1.62	2.02	2.00	2.35
9	2.25	2.02	1.98	2.15	3.90	3.80	2.92	1.98	1.95	2.00	1.95	2.45
10	2.15	2.08	2.00	2.40	3.65	4.55	2.60	1.95	1.88	1.95	1.98	2.45
11	2.20	2.05	2.05	2.42	3.80	5.10	3.05	1.92	1.90	1.90	2.05	2.50
12	2.00	2.06	1.96	2.18	3.88	5.45	3.18	1.90	1.95	1.85	1.92	2.50
13	2.08	2.05	1.95	1.98	3.32	5.88	3.10	1.95	1.92	1.90	1.92	2.48
14	2.05	1.95	2.00	1.98	3.12	5.45	3.18	2.12	2.02	1.90	1.92	2.38
15	2.10	2.02	1.90	2.05	3.08	5.60	3.10	2.10	2.35	1.98	1.82	2.28
16	2.00	2.05	1.90	2.08	3.45	5.75	2.95	2.05	2.78	1.92	1.92	2.20
17	2.10	2.08	1.82	2.28	3.55	5.75	2.72	2.12	2.25	1.98	1.90	2.25
18	2.10	1.95	1.88	2.50	4.02	4.80	2.90	2.25	2.05	1.95	2.05	2.25
19	2.22	2.00	1.88	2.55	4.30	4.60	2.75	1.95	2.00	1.80	2.02	2.35
20	2.10	2.02	1.75	2.52	4.55	4.85	2.88	1.95	2.05	1.95	2.08	2.38

Daily gage height, in feet, of Uncompahgre River at Montrose, Colo., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	2.18	2.00	1.98	2.88	4.15	3.82	2.80	2.25	2.10	2.05	2.15	2.35
22	2.10	2.02	2.02	3.22	4.28	3.88	2.65	2.20	2.05	1.95	2.15	2.35
23	2.50	1.98	2.10	3.60	4.02	3.80	2.75	2.05	1.82	2.05	2.25	2.30
24	2.08	1.90	2.30	3.70	3.82	3.60	3.25	2.30	1.90	2.05	2.40	2.32
25	2.00	1.90	2.25	3.20	3.65	3.45	2.90	2.05	2.40	2.15	2.20	2.32
26	2.05	1.92	2.15	2.85	3.48	3.52	2.75	1.92	2.25	2.25	2.35	2.35
27	2.08	1.92	2.12	2.55	3.25	3.35	3.15	1.92	2.50	2.20	2.40	2.30
28	2.02	2.02	2.10	2.65	3.70	3.20	3.25	1.88	2.45	2.35	2.50	2.30
29	2.08	.....	2.12	2.70	3.95	3.00	3.05	1.88	2.30	2.15	2.52	2.25
30	2.02	.....	2.02	2.72	3.58	3.40	3.08	1.88	2.35	2.05	2.48	2.30
31	2.00	.....	2.00	.....	3.50	.....	2.80	1.68	.....	2.15	.....	2.40

Rating tables for Uncompahgre River at Montrose, Colo.

JANUARY 1, 1905, TO APRIL 22, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.70	32	2.10	69	2.40	111	2.70	163	3.00	231
1.80	39	2.20	82	2.50	127	2.80	184	3.10	257
1.90	47	2.30	96	2.60	144	2.90	207	3.20	285
2.00	57								

APRIL 23, 1906, TO DECEMBER 31, 1906.[b]

1.50	32	2.20	116	2.90	262	3.60	461	4.60	850
1.60	40	2.30	133	3.00	288	3.70	493	4.80	970
1.70	50	2.40	151	3.10	315	3.80	526	5.00	1,125
1.80	61	2.50	170	3.20	343	3.90	560	5.20	1,300
1.90	73	2.60	191	3.30	371	4.00	595	5.40	1,500
2.00	86	2.70	213	3.40	400	4.20	671	5.60	1,725
2.10	100	2.80	237	3.50	430	4.40	755	5.80	1,970

[a] This table is applicable only for open-channel conditions. It is based on one discharge measurement made during 1906 and the form of previous curves and is not well defined.

[b] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906 and is well defined between gage heights 2 feet and 4 feet.

Monthly discharge of Uncompahgre River at Montrose, Colo., for 1906.

[Drainage area, 565 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	127	57	71.9	4,420	0.127	0.15
February	76	47	60.6	3,370	0.107	.11
March	96	36	56.9	3,500	0.101	.12
April	493	49	150	8,930	0.265	.30
May	825	160	456	28,000	0.807	.93
June	2,070	288	796	47,400	1.41	1.57
July	461	160	276	17,000	0.488	.56
August	250	48	111	6,820	0.196	.23
September	232	32	93.1	5,540	0.165	.18
October	142	61	94.9	5,840	0.168	.19
November	174	73	105	6,460	0.186	.21
December	191	116	148	9,100	0.262	.30
The year	2,070	32	202	146,000	.357	4.85

NOTE.—Values are rated as follows: January to March, August to December, fair; April and July, good; May and June, excellent.

UNCOMPAHGRE RIVER AT DELTA, COLO.

This station was established April 29, 1903. It was originally located at a highway bridge one-fourth mile above the Denver and Rio Grande Railroad bridge, but on November 17, 1903, the station was removed to the Denver and Rio Grande Railroad bridge, one-fourth mile northwest of the Denver and Rio Grande Railroad station, in order that the measured discharge of the river might include the mill-ditch waste. Excluding the discharge of seasonal high water in May or June and an occasional rise from local storms, the water passing this station is entirely seepage water from irrigation above. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 125, where are given also references to publications that contain data for previous years.

Discharge measurements of Uncompahgre River at Delta, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 13	R. I. Meeker	55	51	1.15	63
May 8	do	65	176	3.20	867
May 9	do	65	176	3.18	844
May 30	do	65	184	3.25	850
May 31	do	65	172	3.01	722

Daily gage height, in feet, of Uncompahgre River at Delta, Colo., for 1906.

Day.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.
1	1.51	0.88	1.82	2.83	1.82	1.47	0.98	1.63	1.84
2	1.42	0.88	1.64	2.78	1.81	1.80	1.08	1.63	1.85
3	1.36	0.90	1.62	2.62	1.68	1.76	1.10	1.56	.....
4	1.37	0.95	1.71	2.48	1.60	1.67	1.10	1.50	.....
5	1.37	0.90	2.37	2.53	1.48	1.60	1.04	1.49	.....
6	1.31	0.89	2.57	2.35	1.22	1.67	1.02	1.52	.....
7	1.28	0.96	2.92	2.40	1.17	1.47	1.03	1.52	.....
8	1.22	1.18	3.07	2.24	1.39	1.36	1.01	1.51	.....
9	1.27	1.02	3.27	2.22	1.18	1.25	1.01	1.46	.....
10	1.16	1.01	3.21	2.50	1.06	1.15	1.00	1.40	.....
11	0.99	1.44	3.25	3.05	1.06	1.04	1.06	1.36	.....
12	1.08	1.40	3.33	3.28	1.21	1.05	1.04	1.38	.....
13	1.19	1.16	3.36	3.52	1.16	1.05	1.02	1.39	.....
14	1.23	0.98	3.17	3.91	1.09	1.04	1.01	1.41	.....
15	1.12	0.88	2.91	3.70	1.26	1.06	1.23	1.42	.....
16	1.01	0.90	2.98	3.71	1.20	1.09	1.67	1.41	.....
17	1.02	0.94	3.25	3.87	1.15	1.06	1.91	1.40	.....
18	1.01	1.30	3.48	3.77	1.09	1.11	1.51	1.38	.....
19	0.97	1.59	3.65	3.06	1.38	1.10	1.42	1.37	.....
20	0.98	1.59	3.82	3.00	1.30	1.04	1.37	1.52	
21	1.06	1.87	3.92	2.78	1.27	1.07	1.39	1.65	.....
22	1.18	2.46	3.80	2.52	1.20	1.34	1.36	1.65	.....
23	1.18	2.93	3.56	2.54	1.14	1.56	1.36	1.63	.....
24	1.14	3.22	3.65	2.39	1.49	1.38	1.41	1.71	.....
25	1.27	2.61	4.10	2.22	1.58	1.20	1.48	1.70	.....
26	1.28	2.29	3.37	2.17	1.25	1.15	1.69	1.75	.....
27	1.29	2.10	3.02	2.09	1.50	1.13	1.80	1.79	.....
28	1.14	1.86	3.15	1.95	1.63	1.06	1.84	1.83	.....
29	1.11	2.03	3.42	1.79	1.86	1.04	1.78	1.85	.....
30	1.01	1.72	3.26	1.80	1.87	0.99	1.69	1.81	.....
31	0.92	.....	3.04	.....	1.61	1.00	.....	1.73	.....

NOTE.—The river was gorged with ice during January and February.

Rating table for Uncompahgre River at Delta, Colo., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	27	1.60	152	2.30	383	3.00	725	3.70	1,190
1.00	38	1.70	179	2.40	425	3.10	785	3.80	1,265
1.10	51	1.80	208	2.50	470	3.20	845	3.90	1,345
1.20	67	1.90	239	2.60	515	3.30	910	4.00	1,425
1.30	85	2.00	272	2.70	565	3.40	975	4.10	1,510
1.40	105	2.10	307	2.80	615	3.50	1,045		
1.50	128	2.20	344	2.90	670	3.60	1,115		

NOTE.—The above table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904-1906 and is well defined.

Monthly discharge of Uncompahgre River at Delta, Colo., for 1906.

[Drainage area, 1,130 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
March	130	29	65.6	4,030	.058	.07
April	858	25	175	10,400	.155	.17
May	1,510	157	827	50,800	.732	.84
June	1,350	205	629	37,400	.557	.62
July	230	46	108	6,640	.096	.11
August	208	37	82.8	5,090	.073	.08
September	242	36	97.7	5,810	.086	.10
October	224	97	145	8,920	.128	.15
The period				129,000		

NOTE. Values are rated as follows: May and June, excellent; remainder of the period, good.

COLORADO RIVER DRAINAGE BASIN BETWEEN JUNCTION OF GRAND AND GREEN RIVERS AND YUMA.

COLORADO RIVER.

DESCRIPTION OF RIVER.

From the junction of Grand and Green rivers the Colorado flows southwestward, passes across the northwestern corner of Arizona, then turns to the south and for the remainder of its course forms a part of the southeastern boundary of Nevada and California and the western boundary of Arizona. It empties into the Gulf of California about 60 miles below Yuma, Ariz. The canyons through which it flows are world famed and need not here be described.

The Colorado has been called the Nile of America, and like the Nile it is subject to an annual summer rise which comes at the time when it is most needed for irrigation. It is of interest to compare the Colorado with Nile and Susquehanna rivers. The Nile is similar in type, while the Susquehanna shows the difference in flow between arid and humid regions. In the comparison a normal year based upon records of the past ten years for the Colorado and Susquehanna rivers and such data as could be found in regard to the

Nile have been used. The Colorado has been taken as the standard of comparison.

The Nile has 5.7 times the drainage area and the Susquehanna about one-eighth the area of the Colorado.

The rainfall in the Nile basin is 3.8 times greater; that in the Susquehanna basin is 4.5 times greater. The run-off per square mile from the Nile basin is 1.9 times greater; that from the Susquehanna basin is 37 times greater. The ratio of run-off to rainfall in the Nile basin is 2 times smaller; that of the Susquehanna basin is 8.2 times greater.

The discharge of the Nile is 10.8 times greater; that of the Susquehanna is 4.5 times greater.

The maximum flow of the Colorado is from 70,000 to 110,000 second-feet and occurs in May, June, or July; for the Nile it is about 353,000 second-feet and occurs about the first of September; for the Susquehanna it is from 200,000 to 400,000 second-feet and occurs during March, April, and May.

The minimum flow of the Colorado is from 2,500 to 3,000 second-feet and occurs during January and February; that of the Nile is about 14,500 second-feet and occurs about the end of May; for the Susquehanna it is from 2,500 to 5,000 second-feet and occurs in September and October.

The mean flow of the Colorado is about 10,700 second-feet; for the Nile it is about 115,800 second-feet; for the Susquehanna it is about 43,000 second-feet.

The water of the Colorado carries an immense amount of sediment, reaching as high as 2,000 parts of sediment to 100,000 parts of water. Prof. R. H. Forbes, in Bulletin No. 44, University of Arizona Agricultural Experiment Station, says:

> On the basis of the profile constructed from available data for the volume of flow of the Colorado, and of the year's silt determinations made in the laboratory, it is estimated conservatively that the river during 1900 brought down about 61,000,000 tons of sedimentary material, which, condensed to the form of solid rock, is enough to cover 26.4 square miles 1 foot deep, or to make about 164 square miles of recently settled, submerged mud 1 foot deep, reckoning the whole amount of mud for the year to average 6.2 times the bulk of the solid sediment.

A comparatively small amount of land is irrigated by the waters of the Colorado, owing to the fact that the stream and its tributaries are situated so far below the level of the irrigable lands as to render their diversion extremely difficult or impracticable. There are two pumping plants that lift water for irrigation at Yuma and several at other points on the river above Yuma. The Imperial canal diverts water from the river at a point about 10 miles by river below Yuma.

The principal tributaries of the Colorado below the Grand and Green are San Juan, Little Colorado, Williams Fork, and Gila rivers,

which enter from the east, and Virgin River, which enters from the west. With the exception of Virgin River and Williams Fork, these streams and their various tributaries are described in other parts of this report.

COLORADO RIVER AT HARDYVILLE, ARIZ.

This station was established May 11, 1905. It is maintained in cooperation with the State of California, and is located one-fourth mile above the deserted town of Hardyville and 7 miles above Fort Mohave, Ariz. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 128.

Discharge measurements of Colorado River at Hardyville, Ariz., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 1	C. W. Jenkins	440	1,530	3.70	3,430
January 7	do	430	1,460	3.50	3,440
January 14	do	430	1,310	3.30	3,360
January 21	do	435	1,660	4.15	5,900
January 28	do	435	1,840	4.50	7,850
February 5	do	435	1,680	4.10	5,110
February 12	do	435	1,720	4.40	6,390
February 25	do	435	1,590	4.30	6,350
March 4	do	372	1,470	4.10	5,710
March 11	do	375	1,460	4.20	1,520
March 18	do	445	3,180	6.40	19,400
March 25	do	445	2,630	5.80	12,800
April 1	do	455	4,320	7.50	30,000
April 8	do	455	3,600	6.90	21,500
April 15	do	455	3,750	7.30	24,100
April 22	do	470	4,480	8.10	32,200
April 24	Murphy and Lee	470	5,010	8.84	37,500
May 3	Lee and Jenkins	460	5,110	9.00	40,800
May 6	C. W. Jenkins	470	4,600	8.70	33,100
May 13	do	485	7,090	11.20	67,200
May 20	C. H. Lee	497	7,960	11.90	63,700
May 27	C. W. Jenkins	550	9,400	14.60	92,800
June 3	do	500	10,700	14.05	96,200
June 9	do	500	10,400	13.10	92,000
June 16	do	500	9,060	14.40	109,000
July 1	F. T. Cavin	470	8,860	10.35	63,700
July 8	Lee and Cavin	470	7,090	9.30	47,500
July 15	F. T. Cavin	468	5,500	8.50	34,600
July 22	do	468	5,990	8.56	38,100
July 29	do	464	4,800	7.55	27,600
August 5	do	462	4,070	7.35	24,400
August 11	do	460	3,540	7.00	19,500
August 18	do	455	3,070	6.45	16,200
August 25	do	452	2,860	6.20	14,200
September 1	do	454	2,900	6.50	15,500
September 8	do	459	2,770	6.63	12,700
September 15	do	456	2,520	6.50	11,400
September 22	C. J. Brunk	460	2,390	6.73	12,100
September 29	do	464	3,110	7.38	16,900
October 6	do	466	3,200	7.63	16,000
October 13	do	455	2,470	7.00	12,000
October 20	do	451	2,150	6.75	9,840
October 28	do	452	1,910	6.60	8,400
November 4	do	445	1,930	6.80	9,470
November 10	do	461	2,290	7.30	12,800
November 17	do	458	2,180	7.15	10,300
November 24	do	455	1,960	6.85	9,430
December 1	do	450	1,750	6.70	7,720
December 8	do	470	3,420	8.48	23,300
December 15	do	451	2,410	7.25	11,300
December 22	do	449	1,890	6.89	9,230
December 29	do	398	1,530	6.50	7,160

Daily gage height, in feet, of Colorado River at Hardyville, Ariz., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	.....	4.4	7.85	9.5	13.2	10.25	7.4	6.5	.....	6.65	6.7
2	3.50	4.1	4.2	8.25	9.2	13.8	10.0	7.4	6.35	7.5	6.6	6.65
3	3.5	4.05	4.2	7.9	9.1	14.0	.....	7.6	6.35	7.7	.....	6.7
4	3.4	4.1	4.1	7.4	9.2	13.8	9.4	7.5	6.5	7.7	6.8	6.65
5	3.35	4.1	4.1	7.45	8.9	13.75	9.4	7.35	6.5	7.7	6.75	6.6
6	3.4	4.1	4.1	7.1	8.8	13.8	9.2	7.2	6.55	7.6	.....	6.8
7	3.5	4.2	4.1	6.85	8.7	13.6	9.35	7.0	6.55	7.4	6.9	7.45
8	3.35	4.2	4.2	6.9	8.1	13.3	9.25	7.1	6.7	7.3	6.9	8.45
9	3.3	4.3	4.2	6.9	8.7	13.0	9.35	7.0	6.7	7.2	7.0	7.9
10	3.45	4.4	4.2	6.9	9.3	13.1	9.1	7.0	6.7	7.1	7.3	7.7
11	3.3	.....	4.25	7.1	10.1	13.25	8.9	7.05	6.55	7.1	7.3	.....
12	3.35	4.4	4.2	7.1	10.5	13.5	8.8	6.85	6.6	7.1	.....	7.5
13	3.3	4.4	4.35	7.6	11.05	13.1	8.8	6.8	6.55	7.0	7.3	7.4
14	3.4	4.4	4.5	7.5	11.85	13.95	8.45	6.7	6.55	7.0	7.2	7.3
15	3.35	4.3	5.1	7.35	11.9	.....	8.5	6.65	6.55	6.95	7.15	7.25
16	3.4	4.3	.....	7.4	12.5	14.1	8.35	6.6	6.55	6.9	7.15	7.1
17	3.7	4.3	6.4	7.45	12.75	14.6	8.55	6.55	6.5	6.85	7.15	6.95
18	3.8	4.25	6.35	7.6	12.6	14.8	8.5	6.45	6.6	6.8	7.1	6.95
19	3.9	4.2	5.9	7.6	12.1	15.2	8.55	6.45	6.9	6.8	7.0	6.9
20	4.2	4.1	5.8	7.6	11.9	15.4	8.65	6.25	6.7	6.75	6.9	6.9
21	4.15	4.2	5.9	7.9	12.3	15.0	8.75	6.2	6.6	6.7	6.85	6.9
22	4.5	.....	5.9	8.1	12.75	15.0	8.6	6.1	6.75	6.7	6.85	6.85
23	4.4	4.2	5.8	.....	13.4	14.35	8.55	6.3	7.2	6.7	6.9	6.75
24	4.3	4.2	5.8	8.8	13.7	13.8	8.35	6.6	7.0	6.65	6.85	6.65
25	4.4	4.3	5.8	8.9	14.2	13.1	8.15	6.2	6.9	6.6	6.85	6.55
26	4.5	4.3	6.5	9.2	14.2	12.4	8.05	6.2	7.0	6.6	.....	6.45
27	4.4	4.3	6.4	9.8	14.55	11.85	7.85	.....	7.0	6.55	6.85	6.4
28	4.45	4.4	6.3	10.4	14.5	11.6	7.65	6.35	.....	6.6	6.9	6.4
29	4.4	.....	6.55	10.3	.....	11.2	7.55	6.45	7.4	6.75	6.9	6.5
30	4.4	.....	7.3	10.0	13.9	10.6	7.55	6.5	7.6	.....	6.8	6.55
31	4.3	.....	7.75	.....	13.4	.....	.....	.....	.....	6.75	.....	6.5

Daily discharge, in second-feet, of Colorado River at Hardyville, Ariz., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3,430	6,100	6,700	33,600	45,900	83,500	62,600	25,000	15,500	17,800	8,300	7,720
2	3,000	5,600	6,000	36,900	42,900	91,700	59,000	25,000	13,200	16,000	8,000	6,800
3	3,100	5,200	6,000	32,800	41,800	95,500	55,000	29,000	12,500	17,500	8,600	6,700
4	2,900	5,250	5,700	27,300	41,300	94,300	51,000	27,000	13,500	16,800	9,470	6,000
5	2,850	5,110	5,700	27,100	36,400	95,000	50,500	24,400	13,000	16,600	8,900	5,500
6	3,100	5,000	5,650	23,600	34,000	96,500	47,500	21,500	13,000	15,800	9,200	6,000
7	3,440	5,300	5,600	21,100	34,000	94,500	48,700	18,500	12,200	13,500	9,500	10,100
8	3,150	5,300	5,700	21,500	28,500	93,200	47,000	20,700	13,600	12,800	9,500	23,100
9	3,050	5,700	5,650	21,300	35,600	91,200	47,500	18,800	13,600	12,100	10,000	14,500
10	3,300	6,100	5,600	22,100	42,500	92,000	44,100	19,100	13,600	11,700	12,800	13,000
11	3,200	6,200	5,700	22,800	52,700	93,200	41,000	20,500	12,000	12,000	12,700	12,600
12	3,250	6,400	5,800	22,900	58,500	95,800	39,600	17,800	12,600	12,300	12,500	12,400
13	3,200	6,200	6,700	27,000	65,800	91,000	39,000	18,000	12,100	12,000	12,200	11,700
14	3,500	6,200	7,500	26,100	72,800	100,000	34,500	17,500	12,100	12,000	11,300	11,300
15	3,450	6,000	10,600	24,600	71,500	100,000	34,600	17,200	12,100	11,700	10,700	11,300
16	3,700	6,050	15,000	25,200	77,100	101,000	33,500	17,300	11,700	11,100	10,600	10,100
17	4,500	6,100	19,300	25,700	78,000	105,000	36,000	17,600	11,300	10,800	10,300	9,100
18	4,800	5,900	19,000	27,200	72,300	110,000	35,700	16,200	12,000	10,300	10,200	9,100
19	5,200	5,800	15,400	27,200	68,000	115,000	36,500	16,500	15,000	10,200	9,600	9,000
20	5,700	5,600	14,300	27,300	63,700	116,000	37,200	14,000	12,500	9,840	9,200	9,000
21	5,900	5,850	14,900	30,200	68,500	113,000	39,700	13,500	10,800	9,800	9,000	9,000
22	7,300	5,900	14,300	32,200	73,500	113,000	38,500	12,500	11,800	9,300	9,200	8,900
23	7,000	6,000	13,500	34,100	81,000	106,000	38,000	15,000	16,500	9,200	9,400	8,300
24	6,700	6,050	13,200	37,100	83,000	100,000	35,700	20,300	14,000	8,900	9,430	7,600
25	7,200	6,350	12,800	38,300	89,500	93,000	33,600	14,200	12,500	8,500	9,200	7,000
26	7,700	6,300	18,000	41,700	89,500	85,000	32,600	14,000	13,000	8,450	9,200	6,700
27	7,300	6,300	17,600	48,600	92,200	79,700	30,500	14,100	13,000	8,200	9,200	6,400
28	7,700	6,700	17,200	55,600	93,000	76,700	28,500	15,000	15,000	8,400	9,500	6,400
29	7,200	.....	22,300	54,500	91,000	72,500	27,600	16,500	17,400	9,400	9,500	7,160
30	7,100	.....	26,800	51,200	89,000	66,000	27,500	16,500	19,500	9,400	8,800	7,400
31	6,700	.....	31,800	.....	84,500	.....	27,500	16,500	.....	9,400	.....	7,100

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Colorado River at Hardyville, Ariz., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	7,700	2,850	4,830	297,000
February	6,700	5,000	5,880	327,000
March	31,800	5,600	12,300	756,000
April	55,600	21,100	31,600	1,880,000
May	93,000	28,500	64,500	3,970,000
June	116,000	66,000	95,300	5,670,000
July	62,600	27,500	40,000	2,460,000
August	29,000	12,500	18,400	1,130,000
September	19,500	10,800	13,400	797,000
October	17,800	8,200	11,700	719,000
November	12,800	8,000	9,870	587,000
December	23,100	5,500	9,260	569,000
The year	116,000	2,850	26,400	19,200,000

NOTE.—The above values are good.

SAN JUAN RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

San Juan River rises among the snow masses that crown the high peaks of the San Juan Mountains in southwestern Colorado, flows southwestward into New Mexico, then swings to the west and northwest, passing from San Juan County, N. Mex., across the extreme southwestern corner of Colorado into San Juan County, Utah, in the southwestern part of which it unites with the Colorado.

For the first 75 miles of its course the San Juan is a typical mountain stream, but at Canyon Largo, N. Mex., where it turns westward, its character changes, and it occupies a broad, winding, sandy channel in an arid valley, bordered on each side by terraced mesas. Below the mouth of Mancos River the valley narrows and the river bottom is bounded by abrupt bluffs, broken and cut by dry water channels, and merging farther on into the walls of a deep, narrow, box canyon in which the river flows to its end.

The drainage area includes portions of four States and Territories. Its topography ranges in type from mountainous at the headwaters in Colorado to the types exemplified in the valleys, plateaus, and eroded mesas of Utah, New Mexico, and Arizona. Large areas of eruptive rocks occur in the highest portions of the basin, but the predominating formations are of sedimentary origin. The headwater streams are protected by fine forests of spruce and yellow pine and, at lower elevations, large areas of aspen. The lower basin is practically barren except for an extensive growth of sagebrush, scattered cedars, piñons, and range grasses.

The principal tributaries of the San Juan are Navajo, Piedra, Pine, Florida, Animas, and La Plata rivers, the Animas being the most important.

Animas River has its source in the region above Silverton, draining portions of the Needle and La Plata mountains, the former being the

most rugged of the Rocky Mountain ranges. The river flows southward to the Colorado-New Mexico line and thence southwestward to the point where it joins the San Juan at Farmington, N. Mex. The upper portion of the basin, above Durango, is very mountainous and furnishes the greater part of the run-off. This region is generally well timbered with pine, spruce, and aspen, but large areas consist of naked granite peaks. Immediately above and below Durango the valley broadens and is bordered by mesas and bluffs cut by narrow canyons and covered with sagebrush and scattered pines and piñons; along the stream channels cottonwoods predominate. The rocks of this region are chiefly of sedimentary origin. The soils of the lower valleys consist of sandy loam and are very fertile.

La Plata River rises in the granite masses known as La Plata Mountains, about 25 miles northwest of Durango, Colo., and flows southward to its point of junction with the San Juan. Its drainage basin is a narrow strip parallel to and adjoining the Animas basin. The upper portion of the basin is a well-watered and forest-clad mountain region which merges southward into an arid mesa, plateau, and canyon country. La Plata Valley proper is a narrow, shallow depression from Hesperus down, bounded on both sides by high, broken table-lands and deeply eroded mountains. The lower mountain slopes are covered with piñon, scrub oak, and cedar; the lower valleys support heavy growths of sagebrush and chico; the upper mountain slopes were at one time heavily timbered with spruce and yellow and white pine, but these forests have been largely removed by lumbermen.

The other tributaries of the San Juan need not here be described. Those mentioned are perennial streams but much of their water is diverted for irrigation and never reaches the main river. In addition to the perennial streams are many intermittent creeks throughout New Mexico which contribute large volumes of water during heavy storms.

Much land is now under cultivation along the valleys of the San Juan, Animas, Pine, Florida, and La Plata rivers and the smaller tributaries in Colorado. Numerous small lakes high up in the mountains tend to equalize the flow of some of the tributaries, and many large and small storage-reservoir sites are available which will in time be developed. One large power plant has been constructed in this basin and others are contemplated. The largest deposits of lignite and bituminous and coking coal to be found in the West are in this drainage area.

SAN JUAN RIVER NEAR FARMINGTON, N. MEX.

This station was established June 18, 1904, and discontinued September 22, 1906. It was first located near the Methodist Indian school about 3 miles south of Farmington, N. Mex., and about 2 miles

below the mouth of Animas River. On May 11, 1906, it was removed to the new suspension bridge, which replaces the old one, about 1½ miles above the original location.

Measurements are made from the bridge; the initial point for soundings is the inside face of the south pier.

The new gage, which was read during 1906 by Samuel Thomalson, consists of a cantilever arm, to which a standard chain gage is attached; length of chain, 6.80 feet. The bench mark is a 20-penny spike driven horizontally into a crevice in the sandstone ledge about 30 feet upstream from the gage; elevation, 9.61 feet above the datum of the gage.

Discharge Measurements of San Juan River near Farmington, N. Mex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.		Discharge.
				Old gage.	New gage.	
		Feet.	*Sq. ft.*	*Feet.*	*Feet.*	*Sec.-ft.*
May 11	M. C. Hinderlider	235	1,370	9.70	4.45	11,700
June 4	do	235	1,230	8.70	4.40	9,090
June 8	do	235	1,480	10.20	5.80	12,800

Daily gage height, in feet, of San Juan River near Farmington, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	4.15	4.30	4.85	5.65	6.15	4.75	3.75	2.45	1.50
2	4.10	4.38	4.75	5.78	6.00	5.05	3.80	2.40	1.40
3	4.05	4.48	4.80	5.45	6.05	5.10	3.65	2.30	1.30
4	4.00	4.50	4.75	5.20	6.10	4.60	3.90	2.20	1.30
5	3.95	4.50	4.75	5.30	6.45	4.55	3.85	2.20	1.25
6	3.95	4.52	4.75	5.45	6.90	5.35	3.45	2.10	1.30
7	4.18	4.55	4.82	5.65	7.30	5.85	3.45	2.00	1.20
8	4.30	4.58	4.72	7.10	7.75	5.75	3.35	2.05	1.10
9	4.18	4.60	4.82	6.30	8.25	5.60	3.25	2.00	1.10
10	4.28	4.60	4.88	6.25	8.35	6.15	3.20	1.90	1.20
11	4.20	4.58	4.88	6.65	4.50	7.00	3.15	1.80	1.20
12	4.30	4.60	5.12	7.35	4.70	7.10	3.20	1.65	1.15
13	4.30	4.65	5.10	6.65	4.75	7.20	3.10	1.60	1.10
14	4.32	4.70	5.25	6.75	4.05	7.25	3.25	1.55	1.00
15	4.28	4.65	5.10	6.85	3.60	6.65	3.30	1.60	1.10
16	4.22	4.68	5.15	7.40	3.90	6.50	3.20	1.40	2.10
17	4.25	4.65	5.15	7.20	4.40	6.45	3.00	1.40	2.35
18	4.25	4.72	5.10	7.30	4.95	6.25	2.95	1.40	2.05
19	4.28	4.72	5.05	7.55	5.50	5.60	2.75	1.40	1.85
20	4.32	4.70	5.00	7.55	5.85	5.25	2.65	1.40	1.90
21	4.10	4.72	5.05	7.35	6.35	5.30	2.55	1.60	1.90
22	4.05	4.70	5.10	7.90	6.40	4.60	2.50	2.30	1.90
23	4.15	4.75	5.45	8.70	6.45	4.60	2.55	2.60	.....
24	4.10	4.70	5.45	7.90	6.20	4.25	2.50	2.30	.....
25	4.15	4.72	5.70	7.80	5.55	4.10	2.55	1.90	.....
26	4.25	4.75	7.05	7.10	4.85	4.05	2.55	1.65	.....
27	4.30	4.85	6.35	7.05	4.35	3.85	2.50	1.50	.....
28	4.20	4.75	6.10	7.10	4.45	3.65	2.70	1.40	.....
29	4.30	.....	5.70	6.80	5.00	3.60	3.20	1.40	.....
30	4.32	.....	5.25	6.50	5.00	3.50	3.10	1.40	.....
31	4.25	.....	5.40	.....	4.70	.....	2.60	1.60	.....

NOTE.—Gage heights before May 11 refer to the old gage; those of May 11 and after refer to the new gage established on that date.

LA PLATA RIVER AT HESPERUS, COLO.

This station was established June 14, 1904, in connection with investigations relating to the La Plata project in New Mexico, and discontinued August 18, 1906. It was located at the highway bridge on the west side of Hesperus, Colo. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 140, where are given also references to publications that contain data for previous years.

Discharge measurements of La Plata River at Hesperus, Colo., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
June 6	M. C. Hinderlider	29	62	2.80	350
June 6	do	29	59	2.70	310
June 8	A. Puetz	29	56	2.60	298
June 11	do	29	67	2.90	349
June 18	do	29	52	2.40	235
June 22	do	29	43	2.30	197
June 28	do	29	30	1.90	90
July 9	do	29	23	1.80	64

Daily gage height, in feet, of La Plata River at Hesperus, Colo., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	0.95	0.85	0.95	1.25	1.85	2.15	1.80	1.20
2	1.00	0.82	0.92	1.05	1.95	2.05	1.72	1.20
3	1.10	0.80	1.02	1.22	2.00	2.00	1.75	1.20
4	1.00	0.82	0.98	0.98	2.20	2.00	1.90	1.20
5	0.90	0.78	0.95	1.25	2.45	1.98	1.90	1.20
6	0.90	0.80	0.95	1.50	3.25	2.65	2.00	1.20
7	0.82	0.80	0.95	1.20	3.80	2.70	2.00	1.20
8	0.80	0.80	0.95	1.18	3.35	2.80	1.90	1.20
9	1.20	0.80	0.98	1.20	3.80	3.05	1.80	1.10
10	1.00	0.80	0.95	1.22	3.00	3.15	1.80	1.10
11	0.90	0.85	0.98	1.25	2.85	3.10	1.70	1.10
12	0.50	0.85	0.95	1.32	3.15	3.00	1.65	1.00
13	0.42	0.88	0.95	1.42	2.40	3.10	1.60	1.00
14	0.40	0.88	0.95	1.62	2.05	3.00	1.60	1.00
15	0.45	0.88	0.95	2.05	2.05	3.05	1.80	1.00
16	0.42	0.92	0.98	2.00	2.25	2.95	1.80	1.00
17	0.42	0.92	0.95	2.15	2.90	2.65	1.58	1.00
18	0.38	0.92	0.95	2.25	3.00	2.45	1.52	1.00
19	0.40	1.05	0.95	2.02	3.00	2.40	1.50	.....
20	0.40	1.10	0.98	2.05	3.05	2.35	1.40	.....
21	0.40	1.15	0.98	2.28	3.00	2.10	1.35	.....
22	0.42	0.95	1.05	2.80	2.90	2.00	1.30	.....
23	0.42	0.90	1.05	2.90	2.55	2.00	1.30	.....
24	0.45	0.88	1.00	2.75	2.05	2.20	1.30	.....
25	0.48	0.92	1.00	2.20	2.00	2.30	1.30	.....
26	0.52	0.95	1.05	2.10	2.00	3.02	1.30	.....
27	0.70	0.95	1.05	2.05	2.00	2.25	1.30	.....
28	0.72	0.95	0.98	2.05	2.25	1.85	1.32	.....
29	0.80	.....	1.00	2.00	2.25	1.98	1.35	.....
30	0.72	.....	1.08	1.98	2.32	1.85	1.32	.....
31	0.82	.....	1.02	.....	2.35	.....	1.30	.....

LA PLATA RIVER NEAR LA PLATA, N. MEX.

This station was established June 1, 1905, in connection with investigations relating to the La Plata project, and discontinued Sept. 24, 1906. It was located on the single-span wooden highway bridge 1 mile southeast of La Plata post-office, N. Mex., in sec. 3, T. 31, R. 13 W., below all points of diversion. After June 4, 1906, gage heights were found by measuring down from a reference point on the floor of the bridge by a rod graduated to read the height directly. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 142.

Discharge measurements of La Plata River near La Plata, N. Mex., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 9	M. C. Hinderlider	35	70	3.28	352
May 10	do	34	66	3.20	338
June 3	do	33	50	2.62	203

Daily gage height, in feet, of La Plata River near La Plata, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.
1	1.20	2.00	0.75	2.10	2.45	2.58	1.15	1.15	1.10
2	1.20	2.10	0.55	2.05	2.35	2.70	1.15	1.15	1.05
3	1.20	1.65	0.55	2.00	2.25	2.55	1.10	1.15	1.05
4	.....	1.10	0.70	2.00	2.40	2.52	1.15	1.15	1.05
5	.....	1.80	0.70	2.00	2.70	2.60	1.10	2.58	1.05
6	.....	0.95	0.65	2.10	2.55	2.80	1.10	1.25	1.05
7	1.30	1.10	0.60	2.35	3.05	3.00	1.10	1.15	1.05
8	1.30	1.00	0.65	2.25	3.05	2.85	1.12	1.12	1.05
9	1.30	0.80	0.75	2.55	3.25	2.85	1.15	1.10	1.05
10	1.30	0.65	0.95	2.55	3.08	2.88	1.15	1.10	1.05
11	1.30	0.75	1.15	2.55	3.10	2.85	1.15	1.12	1.05
12	1.30	0.80	0.95	2.35	3.02	2.82	1.15	1.15	1.05
13	1.30	0.85	0.95	2.35	2.95	2.85	1.15	1.15	1.05
14	1.30	0.85	0.95	2.40	2.70	2.85	1.80	1.10	1.15
15	1.30	0.85	1.20	2.40	2.50	2.80	1.32	1.10	2.15
16	1.30	0.75	1.25	2.65	2.62	2.65	1.20	1.10	2.20
17	1.30	0.85	0.95	2.70	2.68	2.72	2.60	1.10	1.40
18	1.30	0.70	0.85	3.20	3.05	2.50	1.62	1.10	1.20
19	1.30	0.90	0.75	2.75	3.40	2.35	1.30	1.10	1.15
20	1.30	0.85	0.70	2.70	3.48	2.25	1.18	1.30	1.15
21	.....	0.75	0.75	2.95	3.32	2.05	1.15	1.65	1.10
22	.....	0.70	0.95	3.20	3.42	2.00	1.15	1.15	1.10
23	.....	0.70	1.05	3.10	3.20	2.00	1.10	1.10	1.10
24	.....	0.65	1.20	3.05	3.00	1.88	1.10	1.10	1.10
25	.....	0.55	2.65	2.95	2.85	1.55	1.10	1.10	.....
26	.....	0.50	2.40	2.80	2.62	1.25	1.10	1.10	.....
27	.....	0.50	2.45	2.70	2.45	1.18	1.10	1.10	.....
28	1.60	0.75	2.20	2.60	2.55	1.12	1.10	1.10	.....
29	1.75	.....	2.25	2.55	2.62	1.15	1.10	1.10	.....
30	1.70	.....	2.20	2.60	2.62	1.15	1.10	1.10	.....
31	1.75	.....	2.15	.....	2.60	.....	1.15	1.10	.....

LITTLE COLORADO RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

The country drained by the Little Colorado River consists of a high plateau with an elevation over 4,000 feet above sea level, extending from the Continental Divide in northwestern New Mexico westward to the San Francisco Mountains in Arizona, and from the Grand Canyon of the Colorado southward to the Mogollon Mesa. The greater part of this plateau is composed of rolling plains with a few feet of soil at the surface underlain by rock. Through this plateau the river winds northwestward to its junction with the great Colorado.

The run-off from approximately 6,000 square miles of the drainage area finds its way into the Little Colorado above the mouth of Rio Puerco, the largest tributary which joins the main stream 2 miles above the town of Holbrook, Ariz. Both the Little Colorado and the Rio Puerco are flashy streams, seldom clear even during low stages. They have shifting, sandy bottoms, and when not confined in canyons the stream beds are wide with abrupt earth banks. The discharge fluctuates greatly, being insignificant in dry seasons. The floods are short and violent and carry large quantities of silt in suspension.

LITTLE COLORADO RIVER AT WOODRUFF, ARIZ.

This station was established March 16, 1905. It is located about 100 yards below the crossing of the Holbrook-Winslow wagon road and one-fourth mile below the Woodruff dam. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 145.

The station equipment which was carried away by the flood of November 26 and 27, 1905, was replaced March 24, 1906. A new cable 210 feet long, car, and tag wire were erected, also a combined vertical and inclined rod was placed in the same location as the old one.

The bench marks previously used were replaced by the following: Bench mark No. 1 is the head of a bolt in a scar in a tree, to which the second inclined section is fastened; elevation, 14.92 feet. Bench mark No. 2 is the head of a bolt in a scar on the river side of the fifth cottonwood tree south in a row, to which the last section of the gage rod is fastened; elevation, 23.02 feet. Elevations refer to the datum of the gage.

Discharge measurements of Little Colorado River at Woodruff, Ariz., by R. L. Newman, in 1906.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
January 3	0.3	25	June 29 [b]		4.2
January 4	.3	26	July 3		4.3
January 5	.3	25	July 6		6.4
January 16	4.75	395	July 12		6.3
January 17	5.0	444	July 13		5.7
January 18	3.5	184	July 16		7.0
January 23	1.3	124	July 18		14
January 24	1.0	106	July 20		21
January 25	.9	106	July 23 [b]		19
January 29	1.0	108	July 24	2.0	19
January 31	.7	107	July 26	3.0	228
February 1	.5	86	July 27	2.0	24
February 2	.9	128	July 31	1.5	2.6
February 5	1.35	186	August 1	1.5	2.7
February 6	1.2	187	August 3	2.2	49
February 8	1.7	262	August 6	1.6	4.2
February 9	1.8	254	August 7	1.6	3.4
February 12	1.7	260	August 9	2.6	165
February 14	1.2	199	August 10	2.0	50
February 15	1.0	144	August 13	2.2	39
February 16	.9	141	August 20	3.5	501
February 19	.9	145	August 23	1.3	66
February 21	.8	129	August 24	2.4	67
February 22	.9	146	August 27	1.9	37
February 23	.9	151	August 28	1.8	28
February 26	.7	134	August 30	1.4	18
February 28	.6	127	August 31	1.4	23
March 1	.6	150	September 2 [c]	1.4	6.9
March 2	.5	143	September 4	1.3	5.7
March 5	.5	143	September 6	1.3	2.4
March 6	.6	140	September 7	1.2	2.1
March 8	.5	72	September 10	1.0	1.1
March 9	.5	85	September 11	1.0	.7
March 14	8.85	1,620	September 13	.9	.5
March 15	5.5	786	September 17	.9	.5
March 20	2.7	290	September 18	.9	.5
March 23	1.7	150	September 20	.9	.5
March 26	5.3	1,110	September 21	.9	.5
March 28	4.3	663	September 24	.9	.6
March 29	3.9	539	September 25	1.0	1.3
March 30	3.7	552	September 26	1.0	1.3
April 3	2.2	223	September 27	1.9	43
April 4	2.2	221	September 30	2.8	166
April 6	2.1	213	October 1	2.3	98
April 8	5.45	808	October 3	1.4	17
April 10	3.5	517	October 5	1.3	14
April 12	2.2	256	October 7	1.3	13
April 16	2.5	266	October 9	1.2	12
April 18	2.5	317	October 11	1.2	9.0
April 23	2.7	371	October 19	1.1	7.6
April 24	2.7	376	October 22	1.2	11
April 27	2.6	367	October 24	1.3	8.8
April 29	2.6	191	October 26	1.2	4.6
April 30	2.6	174	October 28	1.2	5.0
May 2	2.4	141	October 31	1.2	3.9
May 4	2.3	130	November 1	1.3	5.3
May 7	2.1	140	November 2	1.2	3.8
May 9 [a]	2.25	82	November 5	1.2	6.4
May 14	1.8	20	November 7	1.2	5.5
May 15	1.8	21	November 9	1.3	6.6
May 18	1.6	13	November 11	1.2	8.3
May 21	1.4	8	November 12	1.2	7.5
May 22	1.4	10	November 15	1.2	7.4
May 23	1.4	9	November 18	1.2	7.7
May 24	1.4	9	November 23 [b]		6.9
May 25	1.4	9	November 26	1.85	18
May 28	1.4	9	November 27	1.5	12
May 29	1.4	10	November 29 [b]	1.3	5.7
May 30	1.4	5	December 4	7.95	1,980
June 4	1.4	4	December 5	3.65	571
June 6	1.4	4	December 12	.9	119
June 7	1.4	4	December 14	.9	103
June 8	1.4	3	December 17	.7	79
June 12 [b]		4	December 20	.4	44
June 14 [b]		4	December 23	.2	23
June 18 [b]		4	December 26	.2	22
June 22 [b]		4.3	December 30	3.5	430
June 25 [b]		4.2			

[a] Measurement made by H. S. Reed. [b] Measured at different section. [c] Irrigation ditch running full.

Daily gage height, in feet, of Little Colorado River at Woodruff, Ariz., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.3	0.5	0.65	2.6	2.3	1.4	.....	1.5	1.3	2.3	1.25	1.3
2	.2	.85	.5	2.05	2.3	1.4	.....	2.5	1.4	1.65	1.25	1.4
3	.25	1.15	.5	2.2	2.3	1.4	.....	1.75	1.35	1.45	1.2	2.25
4	.3	1.2	.5	2.2	2.3	1.4	.....	1.7	1.3	1.4	1.2	8.1
5	.3	1.35	.5	2.2	2.15	1.4	.....	1.7	1.3	1.3	1.2	3.7
6	.3	1.05	.5	2.1	2.0	1.4	.....	1.6	1.3	1.2	1.2	2.9
7	.3	1.7	.5	3.2	2.1	1.4	.....	1.6	1.2	1.25	1.2	2.55
8	.3	1.85	.5	5.25	2.15	1.4	.....	1.95	1.15	1.25	1.3	1.9
9	.3	1.85	.5	4.5	2.25	1.4	.....	2.65	1.1	1.2	1.25	1.7
10	.3	1.65	.5	3.25	2.2	1.4	.....	2.2	1.0	1.2	1.15	1.15
11	.3	1.4	.4	2.8	2.05	1.4	.....	1.95	1.0	1.2	1.1	.9
12	.3	1.55	.45	2.5	1.85	1.4	.....	2.2	1.0	1.0	1.2	.9
13	.3	1.7	12.5	2.25	1.8	1.4	.....	2.15	.9	1.0	1.2	.9
14	.3	1.2	9.15	2.35	1.8	1.1	.....	2.25	.9	1.1	1.2	.9
15	1.9	1.0	5.0	2.6	1.8	1.4	.....	2.1	.9	1.05	1.2	.9
16	4.5	.9	3.85	2.45	1.75	1.25	.....	2.3	.9	1.0	1.2	.9
17	4.0	.7	3.4	2.5	1.65	1.1	.....	2.3	.9	1.05	1.2	.75
18	4.1	.85	2.95	2.5	1.55	1.1	.....	2.25	.9	1.0	1.2	.6
19	4.15	.9	3.4	2.45	1.4	1.1	.....	2.2	.9	1.1	1.1	.5
20	2.95	.8	2.75	2.5	1.4	1.0	.....	2.75	.9	1.05	1.2	.45
21	2.4	.8	2.15	2.4	1.4	1.45	2.0	2.55	.9	1.2	1.2	.2
22	1.75	.9	1.9	2.4	1.4	.7	1.95	2.35	0.9	1.2	1.15	.2
23	1.2	.9	1.7	2.65	1.4	(a)	2.0	1.3	.9	1.2	1.15	.2
24	1.0	.9	1.85	2.65	1.4	.....	1.9	1.9	.9	1.25	1.2	.2
25	.95	.8	1.9	2.7	1.4	.....	1.5	1.65	.95	1.2	1.2	.2
26	1.05	.7	4.55	2.6	1.4	.....	2.75	1.45	.95	1.2	1.45	.2
27	1.05	.65	7.0	2.65	1.4	.....	2.05	1.65	1.5	1.2	1.55	.25
28	.95	.6	4.75	2.6	1.4	.....	1.6	1.65	2.15	1.2	1.3	.35
29	.95	.....	4.1	2.65	1.4	.....	1.7	1.35	2.45	1.15	1.3	3.05
30	.65	.....	3.6	2.55	1.4	.....	1.6	1.4	2.9	1.2	1.3	3.45
31	.7	.....	2.85	.....	1.4	.....	1.5	1.3	.....	1.2	.....	2.2

[a] Water filling reservoir, June 23 to July 21.

Daily discharge, in second-feet, of Little Colorado River at Woodruff, Ariz., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	25	86	153	300	141	4	4	3	15	85	5	7
2	22	124	143	186	135	4	4	100	7	30	4	9
3	23	159	142	223	133	4	4	27	6	18	4	33
4	25	165	141	221	130	4	5	24	6	16	5	2,070
5	25	186	140	226	120	4	6	24	4	14	6	590
6	25	167	117	200	100	4	6	19	2	10	5	435
7	25	275	92	407	140	4	6	19	2	12	6	370
8	25	310	72	786	150	4	6	40	2	12	6	220
9	25	265	85	660	167	3	6	127	2	10	6	206
10	25	235	85	453	160	4	6	60	1	10	7	145
11	25	202	80	378	105	4	6	40	1	10	8	110
12	25	233	82	325	50	4	6	60	1	7	8	119
13	25	270	2,285	254	30	4	6	39	1	7	8	110
14	25	200	1,672	281	20	4	6	65	1	8	7	103
15	79	144	700	325	21	4	6	50	1	7	7	110
16	345	141	495	282	18	4	7	70	1	7	7	110
17	257	118	418	297	15	4	10	70	1	7	7	90
18	275	135	338	302	12	4	14	65	1	7	7	70
19	283	145	415	291	9	4	17	60	1	8	7	55
20	158	133	300	304	9	4	21	151	1	7	7	52
21	141	129	215	260	8	4	20	311	1	10	7	22
22	128	146	178	254	10	4	19	281	1	10	7	22
23	118	151	150	356	9	4	19	70	1	10	7	22
24	106	153	175	358	9	4	19	67	1	8	7	22
25	106	145	182	380	9	4	11	57	1	6	7	22
26	111	134	760	350	9	4	176	46	1	5	10	22
27	111	130	1,867	375	9	4	29	37	23	5	11	26
28	106	127	820	225	9	4	6	28	68	5	8	40
29	107	.....	601	250	10	4	11	23	105	4	8	364
30	102	.....	534	184	5	4	6	18	185	5	7	425
31	107	.....	365	.....	5	.....	2	23	.....	4	.....	260

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Little Colorado River at Woodruff, Ariz., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	345	22	96.3	5,920
February	310	86	172.	9,550
March	2,280	72	445.	27,400
April	786	184	323.	19,200
May	167	5	56.7	3,490
June	4	3	4.0	238
July	176	2	15.2	935
August	311	3	66.9	4,110
September	185	1	14.8	881
October	85	4	11.7	719
November	11	4	6.9	411
December	2,070	7	202.	12,400
The year	2,280	1	118.	85,200

LITTLE COLORADO RIVER AT HOLBROOK, ARIZ.

This station was established March 17, 1905. It is located at the county bridge across Little Colorado River at Holbrook, Ariz. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 149.

Discharge measurements of Little Colorado River at Holbrook, Ariz., by Newman and Reed, in 1906.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
January 17	3.95	932	May 3	5.0	148
January 19	3.6	848	May 6	4.9	100
January 22	3.7	418	May 10	4.9	84
January 24	3.6	429	May 14	4.7	47
January 26	3.4	187	May 20	4.5	23
January 28	3.6	192	May 22	4.5	10
January 30	3.6	173	May 24	4.4	12
February 1	3.7	177	May 27	4.4	10
February 4	3.8	145	June 3	4.4	4
February 7	4.2	282	June 6	4.4	5
February 16	4.0	204	June 10	4.4	6
February 11	4.0	194	June 17	4.3	5
February 13	3.8	144	June 24	4.3	3.4
February 16	3.9	122	July 1	4.3	2.6
February 20	4.05	161	Do	4.3	3.7
February 22	4.0	93	July 14	4.3	4.2
February 25	3.9	86	July 15	4.9	64
February 27	3.7	75	July 17	4.3	10
March 6[a]	3.9	66	July 22	4.7	64
March 11[a]	3.8	65	July 28	4.6	29
March 13	6.85	3,860	August 5	4.8	19
March 22	4.2	196	August 12	4.4	36
Do	4.2	200	August 17	4.7	54
March 25	4.3	206	August 22	4.5	185
March 27	5.8	2,900	August 25	4.9	65
March 29	5.2	1,310	August 28	4.4	29
April 2	4.8	272	August 30	4.5	137
Do	4.8	268	September 2	4.3	40
April 4	4.75	292	September 9	4.2	7.6
April 8	5.8	1,510	September 15	4.0	2.5
April 10	5.7	298	September 17[a]		4.8
April 12	5.5	308	September 21[a]		4.4
April 14	5.4	326	September 24[a]		4.7
April 17	5.4	211	September 28[a]	6.75	847
April 19	5.3	329	September 29	5.0	417
April 21	5.4	405	October 4	4.4	87
April 26	5.4	445	October 6	3.4	12
April 28	5.0	251	October 8[b]		6.2
May 1	5.2	150	October 12[b]		8.8
			October 21[b]		8.6

[a] Measured at different section.

[b] Measurement made at different section.

Discharge measurements of Little Colorado River at Holbrook, Ariz., by Newman and Reed, in 1906—Continued.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
October 28[a]	.....	8.2	December 3	5.0	149
October 29[a]	.....	7.9	December 4	7.15	1,120
October 31[a]	.....	4.6	December 6	4.8	307
November 2[a]	.....	4.2	December 9	4.7	281
November 5[a]	.....	4.2	December 13	4.6	47
November 9[a]	.....	5.1	December 14	4.5	42
November 13[a]	.....	5.1	December 16	4.4	34
November 20[a]	.....	5.4	December 19	4.5	31
November 24[a]	.....	10	December 23	4.5	22
November 27	4.8	63	December 29	.....	1,080
November 30	4.3	25			

[a] Measurements made at different sections.

Daily gage height, in feet, of Little Colorado River at Holbrook, Ariz., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.45	3.8	3.9	4.78	4.9	4.4	4.3	4.6	5.45	4.7	4.0	4.3
2	3.5	3.8	4.0	4.8	4.95	4.4	4.3	5.15	4.65	4.55	4.0	4.3
3	3.5	3.8	4.0	4.7	5.0	4.4	4.3	4.8	4.5	4.35	4.0	5.7
4	3.5	3.8	4.0	4.8	5.05	4.4	4.3	4.8	4.35	4.2	4.0	6.65
5	3.5	3.8	3.9	4.75	5.0	4.4	4.3	4.75	4.2	4.2	4.0	5.15
6	3.5	4.0	4.0	4.78	4.95	4.4	4.3	4.6	4.2	4.2	4.0	4.7
7	3.7	4.1	4.1	5.35	4.9	4.4	4.3	5.45	4.2	4.2	4.0	4.7
8	3.6	4.1	4.0	5.72	4.9	4.4	4.3	4.5	4.2	4.2	4.0	4.7
9	3.6	4.35	3.9	5.15	4.9	4.4	4.3	4.55	4.2	4.2	4.0	4.7
10	3.6	4.1	3.9	5.3	4.9	4.4	4.3	4.5	4.2	4.2	4.0	4.7
11	3.6	4.0	3.9	5.05	4.9	4.4	4.3	4.6	4.2	4.15	4.0	4.7
12	3.6	4.0	3.9	5.0	4.9	4.4	4.3	4.5	4.2	4.0	4.0	4.65
13	3.6	4.2	6.6	5.1	4.85	4.3	4.3	4.4	4.2	4.0	4.0	4.6
14	3.7	4.2	5.5	5.15	4.6	4.3	4.3	4.35	4.2	4.0	4.0	4.6
15	3.7	4.2	4.45	5.2	4.7	4.2	4.3	4.3	4.2	4.0	4.0	4.6
16	5.6	4.1	4.35	5.2	4.7	4.2	4.3	4.3	4.2	4.0	4.0	4.55
17	3.9	4.0	4.3	5.1	4.7	4.2	4.3	4.3	4.2	4.0	4.6	4.5
18	3.8	3.9	4.4	5.1	4.6	4.2	4.3	4.3	4.2	4.0	4.0	4.5
19	3.6	3.9	4.5	5.0	4.6	4.2	4.3	4.25	4.2	4.0	4.0	4.4
20	3.6	4.0	4.6	5.0	4.6	4.2	4.3	4.2	4.2	4.0	4.0	4.4
21	4.0	4.0	4.0	5.15	4.5	4.2	4.3	4.4	4.2	4.0	4.0	4.4
22	3.85	4.0	4.3	5.1	4.5	4.2	4.7	4.4	4.2	3.95	4.0	4.4
23	3.7	4.0	4.3	5.3	4.5	4.2	5.1	5.0	4.2	3.85	4.0	4.4
24	3.7	4.1	4.3	5.2	4.45	4.3	4.95	4.9	4.2	3.8	4.0	4.4
25	3.6	4.0	4.4	5.2	4.4	4.3	4.7	4.9	4.2	3.7	4.3	4.4
26	3.6	4.0	5.02	5.2	4.4	4.3	5.2	4.9	4.2	3.65	4.5	4.4
27	3.6	3.92	6.0	5.1	4.4	4.3	5.0	4.75	4.2	3.6	4.8	4.5
28	3.62	3.85	5.25	5.0	4.4	4.3	4.7	4.6	6.0	3.5	4.5	4.4
29	3.72	.....	5.15	5.0	4.4	4.3	4.6	5.2	5.3	3.5	4.4	6.2
30	3.8	.....	4.95	4.9	4.45	4.3	4.6	5.2	5.15	3.5	4.4	6.05
31	3.8	.....	4.75	.....	4.4	.....	4.6	5.45	.....	4.0	.....	5.85

Daily discharge, in second-feet, of Little Colorado River at Holbrook, Ariz., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	305	194	75	250	90	5	3	20	445	250	4	25
2	330	130	75	270	115	5	3	80	75	170	4	25
3	330	135	75	250	150	5	3	25	60	83	4	460
4	330	140	75	350	150	5	3	25	40	72	4	890
5	330	145	66	290	125	5	3	15	20	30	4	215
6	330	213	75	300	105	5	3	15	17	12	4	255
7	420	245	75	987	97	5	3	145	15	9	4	260
8	370	243	75	925	93	5	3	67	12	6	5	270
9	370	325	100	115	88	5	3	20	10	7	5	235
10	370	240	175	145	84	5	3	30	7	8	5	235

Daily discharge, in second-feet, of Little Colorado River at Holbrook, Ariz., for 1906—Con.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
11	370	195	175	105	80	5	3	50	6	10	5	185
12	370	195	175	100	75	5	3	45	5	9	5	120
13	370	272	3,537	140	65	4	3	35	4	9	5	47
14	420	272	2,173	180	35	4	3	30	4	9	5	45
15	420	272	550	180	45	3	3	25	4	9	5	45
16	1,330	250	375	165	45	3	3	25	4	9	5	43
17	920	200	350	130	45	3	3	25	4	9	5	40
18	896	102	450	155	35	3	3	25	4	9	5	40
19	848	90	550	170	35	3	3	23	4	9	5	35
20	848	88	600	160	35	3	3	17	4	9	5	35
21	935	94	150	185	17	3	3	145	4	9	5	35
22	676	93	350	170	10	3	64	145	4	9	7	35
23	423	93	250	250	10	3	134	275	4	8	8	35
24	429	175	200	200	7	4	99	130	4	8	10	35
25	187	97	400	200	5	4	57	65	4	8	28	35
26	187	100	1,340	200	5	4	140	65	4	8	40	35
27	189	93	3,260	215	5	4	95	55	4	8	63	40
28	194	73	1,435	250	5	4	37	44	600	8	34	35
29	165	.....	1,182	185	5	4	28	155	370	8	25	680
30	168	.....	662	125	7	4	28	155	319	8	25	620
31	168	.....	220	.....	5	.....	28	240	.....	5	.....	530

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Little Colorado River at Holbrook, Ariz., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	1,330	165	452	27,800
February	325	73	170	9,440
March	3,540	66	621	38,200
April	987	100	245	14,600
May	150	5	54.0	3,320
June	5	3	4.1	244
July	140	3	24.9	1,530
August	275	15	71.5	4,400
September	600	4	68.7	4,090
October	250	5	26.6	1,640
November	63	4	11.3	672
December	890	25	181	11,100
The year	3,540	3	161	117,000

Summary of observations of evaporation at Holbrook, Ariz., in 1905–6.

Month.	Amount of evaporation.	Temperature of water.					
		In pan.			Outside pan.		
		Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.
1905.	*Inches.*						
August [a]	6.60	81	66	73.5	80	66	73.6
September	4.57	79	55	66.4	78	56	66.5
October	4.26	73	41	56.9	73	42	56.8
November	[b] 1.45	59	40	48.4	59	40	48.4
December	0.22	48	29	37.5	48	29	37.8
1906.							
January [c]	0.03	35	32	32.4	36	32	32.7
February	1.24	53	33	41.8	52	34	42.1
March	3.28	64	37	46.4	63	38	46.9
April	5.12	69	42	52.5	68	42	52.7
May	6.93	71	49	60.3	70	50	60.4
June	8.61	79	55	65.6	75	54	65.2
July	7.42	80	61	[d] 70.5	81	62	[d] 71.1
August	6.24	76	63	70.4	76	64	71.0
September	5.12	75	55	65.3	75	56	65.7
October	3.44	69	40	56.0	69	41	56.4
November	1.43	57	40	46.1	58	40	46.7
December	.94	46	39	42.4	47	40	43.1
The year	49.80	80	32	.....	81	32	.....

[a] 29½ days. [b] 29 days. [c] For 5 days; the pan was frozen January 5 to 30. [d] 30 days.

LITTLE COLORADO RIVER AT ST. JOHNS, ARIZ.

This station was established April 18, 1906. It is located at the south end of the town of St. Johns, one-half mile above the dam and county bridge.

The channel is straight for 300 feet above and 250 feet below the station. There is a good velocity at all stages, becoming swift at high water. The banks are clean and almost perpendicular, and will not overflow during high water. The bed of the stream is clean, and sandy; it probably shifts slightly. There is one channel at all stages.

Discharge measurements are made by means of a cable, car, and tagged wire. A stay wire is used for high-water measurements. The initial point for soundings is the face of the cable support on the right bank.

The staff gage, which is read by the local hydrographer, W. D. Rencher, is bolted to the framework built out over the bank on the right side of the river at the gaging station. The bench mark is the head of a bolt driven into solid ledge 73 feet northeast from the cable support on the left bank; elevation, 15.43 feet above the zero of the gage.

Discharge measurements of Little Colorado River at St. John, Ariz., by Reed and Rencher, in 1906.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
April 19	6.23	477	August 20	3.98	28
April 19	6.13	424	August 20	4.84	213
April 24	5.78	338	August 23	4.94	112
April 30	5.06	186	September 10	3.94	9.5
May 4	4.90	132	September 17	3.87	7.7
May 8	4.80	148	September 22	3.88	8.2
May 14	4.20	48	September 28	3.94	13
May 18	4.00	35	October 5	3.91	10
May 23	3.93	23	October 11	3.92	12
May 28	3.90	21	October 17	3.90	9.9
June 2	3.82	16	October 24	3.91	11
June 7	3.79	16	October 30	3.91	12
June 15	3.66	8.0	November 5	3.93	13
June 23	3.74	12	November 12	3.94	15
June 28	3.76	13	November 19	3.95	14
July 4	3.79	16	November 24	4.03	19
July 12	3.85	12	November 28	4.07	23
July 18	3.86	14	December 4 [a]	4.96	206
July 28	4.00	24	December 11	4.60	65
August 3	3.93	19	December 15	4.44	48
August 9	4.04	24	December 22	4.10	23
August 14	3.98	16	December 31 [a]	4.68	61

[a] Float measurement.

Daily gage height, in feet, of Little Colorado River at St. Johns, Ariz., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.08	3.84	3.71	4.68	4.29	3.94	3.91	4.09
2	.....	4.92	3.82	3.70	4.31	4.16	3.93	3.92	4.11
3	.....	4.90	3.82	3.75	3.95	4.09	3.92	3.92	4.13
4	.....	4.90	3.82	4.10	3.96	4.05	3.91	3.92	4.61
5	.....	4.82	3.81	3.88	3.91	4.02	3.91	3.93	5.80
6	.....	4.80	3.80	4.17	3.90	3.99	3.90	3.93	5.72
7	.....	4.82	3.79	3.83	3.94	3.97	3.90	3.93	5.10
8	.....	4.80	3.79	3.80	4.04	3.95	3.90	3.94	4.84
9	.....	4.50	3.78	3.80	4.04	3.94	3.90	3.94	4.78
10	.....	4.30	3.74	3.82	4.52	3.93	3.91	3.94	4.74
11	.....	4.25	3.70	3.85	4.15	3.91	3.92	3.94	4.62
12	.....	4.20	3.67	3.85	4.00	3.90	3.92	3.94	4.55
13	.....	4.20	3.66	3.85	3.99	3.89	3.92	3.94	4.50
14	.....	4.20	3.66	3.85	3.98	3.89	3.92	3.94	4.50
15	.....	4.12	3.65	3.84	3.97	3.88	3.93	3.94	4.45
16	.....	4.08	3.65	3.85	4.90	3.88	3.95	3.95	4.29
17	.....	4.02	3.65	3.85	4.15	3.87	3.92	3.95	4.20
18	.....	4.00	3.65	3.86	3.92	3.87	3.90	3.95	4.13
19	6.18	3.94	3.64	3.88	3.89	3.87	3.91	3.95	4.14
20	6.08	4.00	3.64	3.86	4.39	3.87	3.91	3.96	4.12
21	5.82	3.99	3.64	3.86	5.00	3.87	3.90	3.98	4.11
22	6.10	3.95	3.64	3.86	5.45	3.88	3.91	4.00	4.11
23	5.95	3.93	3.76	4.03	4.70	3.88	3.91	4.02	4.12
24	5.90	3.93	3.79	3.93	4.35	3.88	3.91	4.03	4.14
25	5.68	3.90	3.80	3.86	4.26	3.92	3.90	4.05	4.13
26	5.48	3.90	3.80	4.18	4.25	4.05	3.90	4.07	4.12
27	5.40	3.90	3.78	3.88	4.26	4.03	3.90	4.07	4.12
28	5.30	3.88	3.75	3.95	4.19	3.96	3.90	4.08	4.13
29	5.15	3.87	3.74	3.96	4.20	3.97	3.92	4.05	4.24
30	5.08	3.86	3.70	3.90	4.49	3.98	3.91	4.04	4.40
31	.....	3.85	.....	3.86	4.36	.....	3.91	.....	4.69

Daily discharge, in second-feet, of Little Colorado River at St. Johns, Ariz., for 1906.

Day.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	185	18	10	100	46	14	11	23
2	.....	145	17	10	53	33	13	12	25
3	.....	137	17	13	22	26	12	12	26
4	.....	132	17	32	23	21	11	12	69
5	.....	130	16	15	18	18	11	13	533
6	.....	135	16	38	17	15	10	13	502
7	.....	145	15	11	20	13	10	13	260
8	.....	148	15	9	28	11	10	14	159
9	.....	95	14	9	28	10	10	14	135
10	.....	70	12	10	67	9	11	14	120
11	.....	60	10	12	32	9	12	14	73
12	.....	55	8	12	17	9	12	14	60
13	.....	50	8	12	17	8	12	14	54
14	.....	48	8	12	16	8	12	14	54
15	.....	42	7	12	17	8	13	14	50
16	.....	40	7	12	120	8	15	15	37
17	.....	37	7	12	38	8	12	15	31
18	.....	35	7	13	20	8	10	15	26
19	460	27	7	15	18	8	11	15	27
20	415	32	7	13	85	8	11	16	25
21	340	33	7	13	205	8	10	18	25
22	420	27	7	13	260	8	11	20	25
23	380	23	13	27	80	8	11	22	25
24	370	23	15	19	52	8	11	19	27
25	315	21	16	13	43	12	10	20	26
26	265	21	16	39	42	25	10	22	25
27	250	21	14	15	43	23	10	22	25
28	230	20	13	20	36	16	10	23	26
29	200	19	12	21	37	17	12	20	34
30	190	19	10	16	65	18	11	19	46
31	.....	18	.....	13	53	.....	11	.....	100

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Little Colorado River at St. Johns, Ariz., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April 19-30	460	190	320	7,620
May	185	18.0	64.3	3,950
June	18.0	7.0	11.9	708
July	39	9	15.8	972
August	260	16	53.9	3,310
September	46	8	14.2	845
October	15	10	11.3	695
November	23	11	16.0	952
December	533	23	86.2	5,300
The period				24,400

SILVER CREEK AT SNOWFLAKE, ARIZ.

This station was established May 4, 1906. It is located at the southeast end of the town and 2 miles below the dam of Snowflake and Taylor Irrigation Company. All water is shut off by the dam during the entire irrigation season, excepting when rains occur.

The channel is straight for 200 feet above and 150 feet below the station. The current is good at all stages. The right bank is high, sandy, and clean; the left is sandy, is higher than the right and is covered with small willows which serve to hold the soil in place. Owing to the level country and the sudden rains to which this creek is subjected, both banks will probably overflow during extreme high water. The bed of the stream is sandy, level, and clean. There is one channel at all stages, except when the banks overflow and then water is liable to extend over a large area.

Discharge measurements are made by means of a cable and car during high water and by wading at low stages. The initial point for soundings is the first tag wire from the support on the right bank.

The gage, which is read by J. W. Smith twice each day, is a combined vertical and inclined rod on the right bank of the stream at the point of measurement. The bench mark is the head of a bolt in the trunk of a large cottonwood tree 400 feet northeast from the rod; elevation, 16.68 feet above the zero of the gage.

Discharge measurements of Silver Creek at Snowflake, Ariz., by Reed and Newman, in 1906.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
May 8	2.2	1.2	August 1	2.0	1.4
May 18	2.2	.9	August 8	2.1	4.5
May 25	2.2	.8	August 16	2.1	3.4
June 1	2.2	1.0	August 21	2.1	3.6
June 14	2.0	.8	August 29	2.1	3.5
June 21	2.0	.6	September 5	2.0	1.6
June 28	2.0	.9	September 12	1.9	.5
July 6	1.9	.5	September 19	1.9	.4
July 12	2.0	1.7	November 14	2.3	1.4
July 20	2.0	2.0	December 11	2.3	5.4
July 25	2.0	1.2			

Daily gage height, in feet, of Silver Creek at Snowflake, Ariz., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.05	2.00	2.33	2.20	2.30	2.40	2.20
2	.....	2.10	2.00	2.32	2.18	2.28	2.40	2.20
3	.....	2.05	2.00	2.12	2.18	2.22	2.42	3.25
4	.....	2.05	2.35	2.08	2.15	2.20	2.38	6.00
5	.....	2.05	2.03	2.08	2.10	2.20	2.35	4.50
6	2.15	2.05	2.05	2.08	2.12	2.20	2.30	3.80
7	2.15	2.05	2.05	2.08	2.10	2.20	2.28	3.00
8	2.15	2.05	2.05	2.10	2.10	2.18	2.25	2.50
9	2.15	2.00	2.05	2.55	2.08	2.15	2.25	2.38
10	2.15	2.10	2.03	2.25	2.08	2.15	2.38	2.35
11	2.15	2.05	2.00	2.30	2.08	2.30	2.22	2.30
12	2.15	2.10	2.00	2.80	2.02	2.30	2.20	2.30
13	2.15	2.05	2.00	2.42	2.00	2.30	2.25	2.30
14	2.15	2.00	2.00	2.25	1.98	2.30	2.25	2.30
15	2.15	2.00	2.00	2.25	1.95	2.30	2.25	2.25
16	2.15	2.00	2.10	2.45	2.00	2.38	2.25	2.15
17	2.15	2.00	2.20	2.48	2.00	2.32	2.25	2.13
18	2.15	2.00	2.08	2.35	2.00	2.28	2.28	2.08
19	2.15	2.00	2.05	2.22	2.00	2.28	2.30	2.23
20	2.15	2.00	2.03	2.35	2.00	2.28	2.30	2.17
21	2.15	2.00	2.00	2.45	2.00	2.32	2.30	2.17
22	2.15	2.00	2.00	2.40	2.00	2.35	2.30	2.17
23	2.15	2.00	2.03	2.40	2.00	2.32	2.25	2.17
24	2.15	2.00	2.05	2.35	2.00	2.32	2.55	2.17
25	2.15	2.00	2.03	2.25	2.00	2.30	2.70	2.17
26	2.15	2.00	2.00	2.20	2.00	2.22	2.50	2.17
27	2.15	2.00	2.10	2.15	2.00	2.15	2.30	2.20
28	2.15	2.00	2.13	2.15	2.00	2.15	2.25	2.45
29	2.15	2.00	2.05	2.10	3.52	2.18	2.20	4.05
30	2.15	2.00	2.05	2.30	2.52	2.30	2.20	3.70
31	2.15	.....	2.05	2.25	.....	2.38	.....	3.05

Daily discharge, in second-feet, of Silver Creek at Snowflake, Ariz., for 1906.

Day.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1	1	5	2	2	3	3
2	.....	1	1	5	2	2	3	3
3	.....	1	1	2	2	2	3	4
4	.....	1	6	2	2	2	3	50
5	.....	1	1	2	2	2	3	28
6	1	1	1	2	1	2	3	19
7	1	1	1	2	1	2	3	11
8	1	1	1	4.5	1	2	3	8
9	1	1	1	8	1	1.5	3	6
10	1	1	1	4	1	1.5	3	7
11	1	1	1	5	1	2	3	5
12	1	1	2	11	.5	2	2	5
13	1	1	2	1	.5	2	2	5
14	1	1	2	4	.5	2	1.5	5
15	1	1	2	4	.5	2	1.5	5
16	1	1	2	3.5	.5	4	1.5	4
17	1	1	4	3.5	.5	4	1.5	4
18	1	1	3	3	.5	4	3	4
19	1	1	3	3	.5	4	3	5
20	1	1	2	3	.5	4	3	5
21	1	1	2	7	.5	4	3	5
22	1	1	1	6	.5	3	3	5
23	1	1	1	6	.5	3	3	5
24	1	1	1	5	.5	3	4	5
25	1	1	1	4	.5	2	6	5
26	1	1	1	3	.5	2	4	5
27	1	1	1	3	.5	2	3	5
28	1	1	1	3	.5	2	3	6
29	1	1	1	3	20	2	3	22
30	1	1	1	4	8	3	3	18
31	1	.....	1	4	.....	3	.....	11

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Silver Creek at Snowflake, Ariz., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
May (6-31)	1	1	1.0	52
June	1	1	1.0	60
July	6	1	1.6	98
August	11	2	4.0	246
September	20	.5	1.8	107
October	4	1.5	2.5	154
November	6	1.5	2.9	173
December	50	3	9.0	553
The period				1,440

SILVER CREEK AT CANYON STATION NEAR SNOWFLAKE, ARIZ.

This station was established May 2, 1906. It is located at the mouth of Silver Creek canyon just below the town of Snowflake. It was established principally to determine the flood waters of Silver Creek and Cottonwood Wash, which can not be taken care of by the station above. At times Cottonwood Wash carries more water than the main stream.

During the irrigation season the stream is entirely shut off above the Snowflake and Taylor Irrigation Company's dam, 3 miles above. All water passing the section during this period is waste and seepage water.

The channel is straight for 500 feet above and 600 feet below the station. The current is very swift at high water. Both banks are high, are strewn with bowlders, and will not overflow. The bed of the stream at the cable section is of gravel and sand formation. Above and below the cable the bed is covered with cobblestones.

Discharge measurements are made by means of a cable, car, and tagged wire. The initial point for soundings is the first tag on a wire at the right bank.

The gage is a series of inclined rods bolted to solid rock on the right bank of the canyon 100 feet above the gaging section. Bench mark No. 1 is a cross cut into a point of ledge to which the rod is bolted at elevation 26.01 feet above the zero of the gage.

Discharge measurements of Silver Creek at canyon station near Snowflake, Ariz., by Reed and Newman, in 1906.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
May 4	2.6	5.2	August 29 [a]	2.8	19.6
May 9	2.6	2.7	September 5	2.6	2.8
May 18	2.6	2.4	September 12	2.4	1.2
May 25	.....	0.4	September 19	2.4	1.4
May 31	2.6	1.6	September 26	2.4	1.3
June 13	2.5	1.4	October 10	2.8	7.0
June 19	2.5	1.4	October 23	2.7	4.2
June 26	2.5	1.4	October 30	2.7	4.0
July 6	2.6	1.9	November 6	2.6	2.9
July 12	2.6	1.9	November 14	2.7	3.1
July 20	2.6	2.0	November 21	2.7	3.3
July 24	2.6	1.8	November 26	2.9	5.2
August 2	2.6	3.1	December 11	2.9	9.6
August 8	2.6	3.3	December 18	2.8	8.7
August 15	2.6	3.6	December 24	2.7	8.3
August 21	2.7	3.1	December 31 [a]	3.0	31.

[a] Discharge of Cottonwood Wash.

CHEVELON FORK NEAR WINSLOW, ARIZ.

This station was established December 18, 1905. It is located above the mouth of the river, in sec. 34, T. 18 N., R. 17 E., 19 miles east of Winslow, Ariz. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 157.

A staff gage was set about 25 feet upstream from the automatic water stage register on May 14, 1906. The bench mark is a bolt in a rock between the cable and automatic register; elevation, 28.375 feet above zero of both gages.

On October 1, 1906, a well point and 10 feet of 2-inch pipe was laid from the bottom of the tube out into the stream and securely connected to the bottom of the creek and to the float tube. This obviates the trouble caused by sand collecting in and about the bottom of the float tube.

Discharge measurements of Chevelon Fork near Winslow, Ariz., by Reed and Newman, in 1905–1906.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1905.	*Feet.*	*Sec.-ft.*	1906.	*Feet.*	*Sec.-ft.*
November 3		8.2	June 30	−0.20	0.5
November 25	1.00	.9	July 7	− .20	.4
December 19	2.10	33	July 10	− .20	.4
			July 14	− .20	.4
1906.			July 21	− .20	.6
February 3	1.80	57	July 28	.00	1.2
February 10	2.60	135	August 4	.60	2
February 17	2.40	107	August 11	1.00	2.9
February 24	2.90	147	August 18	.10	.7
March 3	2.60	132	August 25		.4
March 12	2.80	148	September 1	.30	1
March 18	3.55	546	September 8		.3
March 19	3.23	453	September 15		.3
March 24	3.10	212	September 22		.3
March 28	4.70	1,250	September 29	.20	.7
March 31	3.20	266	October 6	.10	.3
April 7	1.80	61	October 13	.00	.25
April 14	2.00	66	October 20	− .10	.25
April 21	1.40	21	October 27	− .10	.25
April 28	0.80	4.3	November 3	− .10	.25
May 5	.30	1.2	November 10	− .10	.25
May 12	.20	.7	November 17	− .10	.25
May 19	.20	.7	November 24	− .10	.25
May 26	.10	.6	December 1	− .10	.25
June 3	.00	.5	December 8	5.50	119
June 9	.00	.8	December 15	2.70	37
June 16	.00	.8	December 22	.60	18
June 23	−.10	.4	December 29	.30	16

Daily gage height, in feet, of Chevelon Fork near Winslow, Ariz., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.85	1.77	3.16	3.00	0.65	0.05	−0.15	2.72	0.30	0.23	−0.07	0.60
2	1.85	1.77	3.05	2.90	.57	.05	− .15	.86	.25	.15	− .10	1.97
3	1.85	1.80	2.75	2.66	.52	.05	− .15	.60	.18	.10	− .10	2.15
4	1.85	1.80	2.69	2.41	.45	.05	− .15	.60	.13	.10	− .10	8.16
5	1.80	1.80	2.52	2.44	.38	.05	− .15	.60	.10	.10	− .10	5.75
6	1.80	1.88	2.35	2.05	.34	.05	− .15	.55	.08	.10	− .10	5.70
7	1.80	2.28	2.30	1.73	.32	.05	− .15	2.88	.05	.10	− .10	5.65
8	1.80	2.62	2.27	2.15	.31	.05	− .20	4.07	.48	.10	− .10	5.60
9	1.80	2.60	2.28	2.81	.30	.05	− .20	1.88	1.35	.10	− .10	5.40
10	1.80	2.57	2.50	3.58	.30	.05	− .20	1.00	.45	.10	− .10	5.20
11	1.80	2.52	3.33	3.15	.28	.00	− .20	1.00	.25	.05	− .10	4.95
12	1.80	2.50	2.98	2.56	.25	.00	− .20	.90	.18	.05	− .10	4.60
13	1.80	2.52	8.16	2.21	.25	.00	− .20	.70	.10	.05	− .10	4.20
14	1.80	2.45	7.89	2.05	.20	.00	− .15	.50	.10	.00	− .10	3.60
15	1.80	2.31	5.70	2.36	.20	.00	− .20	1.20	.00	.00	− .10	2.95
16	1.80	2.33	4.77	2.15	.20	.00	− .20	.34	.00	.00	− .10	2.50
17	1.80	2.40	4.30	1.76	.20	.00	− .20	.20	.00	− .05	− .10	2.00
18	1.70	2.43	3.65	1.36	.20	− .05	− .20	.20	.00	− .05	− .10	1.44
19	1.75	2.45	3.28	1.30	.20	− .05	− .20	.20	00	− .10	− .10	.77
20	2.04	2.78	2.95	1.63	.20	− .05	− .20	.20	.00	− .10	− .10	1.08
21	2.62	2.91	2.78	1.56	.20	− .10	− .20	.15	.00	− .10	− .10	.85
22	2.65	2.95	2.88	1.35	.20	− .10	.00	.10	.00	− .10	− .10	.65
23	2.65	3.00	2.79	1.23	.15	− .10	1.75	.10	.00	− .10	− .10	.60
24	2.65	2.90	3.32	1.13	.10	− .10	.60	.05	.00	− .10	− .10	.55
25	2.65	2.64	3.83	1.05	.10	− .15	.23	.00	.00	− .10	− .10	.45
26	2.48	2.52	7.71	1.00	.10	− .15	.32	.00	.00	− .10	− .10	.40
27	1.98	2.65	8.56	.95	.10	− .15	.20	.21	1.37	− .10	− .10	.38
28	1.87	2.90	4.68	.85	.10	− .15	.05	2.58	.60	− .10	− .10	.45
29	1.80	.....	4.05	.77	.10	− .15	.00	1.65	.30	− .10	− .10	.30
30	1.77	.....	3.55	.73	.10	− .15	− .05	.65	.28	− .10	− .10	.30
31	1.77	.....	3.08	.....	.05	.....	1.06	.40	.....	− .10	.....	.30

Daily discharge, in feet, of Chevelon Fork near Winslow, Ariz., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	52	45	251	210	3	0.75	0.5	151	1	0.3	0.25	35
2	52	45	222	187	2	.75	.5	2	1	.25	.25	57
3	52	57	157	142	2	.75	.5	2	1	.25	.25	80
4	52	48	155	110	1	.75	.5	2	0.75	.25	.25	3,600
5	48	48	125	111	1	.75	.5	2	.50	.25	.25	127
6	48	53	101	70	1	.75	.5	2	.5	.25	.25	126
7	48	92	96	44	1	.75	.5	183	1.5	.25	.25	123
8	48	137	93	80	1	.75	.5	832	.25	.25	.25	122
9	48	135	95	169	1	.75	.5	54	18	.25	.25	117
10	48	128	120	498	1	.75	.5	3	.25	.25	.25	110
11	48	125	328	250	1	.5	.5	3	.25	.25	.25	100
12	48	120	207	128	1	.5	.5	2	.25	.25	.25	92
13	48	125	3,600	87	1	.5	.5	2	.25	.25	.25	80
14	48	113	3,430	70	1	.5	.5	2	.25	.25	.25	63
15	48	97	1,930	106	1	.5	.5	14	.25	.25	.25	45
16	48	100	1,298	80	1	.5	.5	1	.25	.25	.25	35
17	48	107	988	45	1	.5	.5	1	.25	.25	.25	29
18	41	111	546	19	1	.5	.5	1	.25	.25	.25	23
19	44	113	303	17	1	.5	.5	1	.25	.25	.25	28
20	69	163	198	37	1	.5	.5	1	.25	.25	.25	20
21	138	190	163	31	1	.5	.5	1	.25	.25	.25	19
22	145	198	183	20	1	.5	.75	.5	.25	.25	.25	18
23	145	210	165	15	.75	.5	40	.5	.25	.25	.25	18
24	145	147	321	12	.75	.5	2	.5	.25	.25	.25	18
25	145	138	668	11	.75	.5	.75	.5	.25	.25	.25	17
26	115	125	3,300	10	.75	0.5	.75	.5	.25	25	.25	17
27	62	140	3,870	8	.75	.5	.75	0.5	119	.25	.25	17
28	53	147	1,237	6	.75	.5	.5	130	2	.25	.25	17
29	48	.....	818	4	.75	.5	.5	38	.75	.25	.25	16
30	45	.....	478	3	.75	.5	.5	2	.75	.25	.25	16
31	45	.....	230	.....	.75	.....	11	2	.....	.25	.....	16

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Chevelon Fork near Winslow, Ariz., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	145	41	66.8	4,110
February	210	45	116	6,440
March	3,870	93	828	50,900
April	498	3	86.0	5,120
May	3.00	.75	1.06	65.2
June	.75	.50	.58	34.5
July	45.0	.50	2.36	145
August	832	.50	46.4	2,850
September	119	.25	5.04	300
October	.30	.25	.25	15.4
November	.25	.25	.25	14.9
December	3,600	16	168	10,300
The year	3,870	.25	110	80,300

CLEAR CREEK NEAR WINSLOW, ARIZ.

This station was established June 13, 1906. It is located 6 miles from Winslow and 3 miles above the Clear Creek Irrigation Company's dam and the county bridge. It is one-half mile above the pump house.

The channel is straight for 250 feet above and 500 feet below the station. The current is good at all stages. Both banks are perpendicular cliffs and will not overflow. The bed of the stream is strewn with large bowlders and is permanent. There is one channel at all stages.

Discharge measurements are made by means of a cable, car, and tagged wire. A stay wire is used for high-water measurements. The initial point is the first tag at the eyebolt to which the tag wire is fastened.

The gage, which is read by E. McFarland, is an automatic water-stage register on a shelf 51 feet above the bottom of the creek. There is also a staff gage 42 feet long bolted to the cliff. The elevation of both gage zeros is the same. The bench mark is a bolt in a wooden plug which has been driven into a hole in the solid ledge 5 feet south of the gage rod; elevation, 35.083 feet above the gage zero.

Discharge measurements of Clear Creek near Winslow, Ariz., by Reed, McFarland and Imel, in 1906.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
June 13	2.0	3.51	October 6	2.0	3.45
June 14	2.0	3.42	October 13	2.0	3.48
June 16	2.0	3.46	October 20	2.0	3.83
June 23	2.0	3.29	October 27	2.0	3.75
June 30	2.0	3.19	November 2	2.0	3.87
July 7	2.0	3.22	November 10	2.0	3.90
July 14	2.0	3.22	November 17	2.0	3.88
July 21	2.0	3.16	November 24	2.2	5.54
July 28	2.0	3.15	December 4	17.4	4.840
August 11	2.0	3.38	December 5	9.0	2,060
August 18	2.0	3.32	December 6	7.0	1,320
August 25	2.0	3.32	December 8	4.7	521
September 1	2.0	3.36	December 10	4.0	333
September 8	2.0	3.43	December 21	3.1	112
September 15	2.0	3.45	December 22	3.1	114
September 22	2.0	3.61	December 29	2.4	31.9
September 29	2.0	3.46	December 31	4.2	284

Daily gage height, in feet, of Clear Creek near Winslow, Ariz., for 1906.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.95	2.70	2.00	2.00	2.00	2.00
2	.....	1.95	2.32	2.00	2.00	2.00	2.23
3	2.00	1.95	2.28	2.00	2.00	2.00	2.43
4	2.00	1.95	2.12	2.00	2.00	2.00	8.38
5	2.00	1.95	1.95	2.00	2.00	2.00	9.73
6	2.00	1.95	1.98	2.00	2.00	2.00	7.40
7	2.00	1.95	1.96	2.00	2.00	2.00	5.30
8	2.00	1.95	2.32	2.00	2.00	2.00	4.45
9	2.00	1.95	2.55	2.00	2.00	2.00	3.88
10	2.00	1.95	2.20	2.00	2.00	2.00	3.40
11	2.00	1.95	2.32	2.00	2.00	2.00	3.10
12	2.00	1.95	2.15	2.00	2.00	2.00	3.08
13	2.00	1.95	2.15	2.00	2.00	2.00	2.86
14	2.00	1.95	2.15	2.00	2.00	2.00	4.05
15	2.00	2.00	2.15	2.00	2.00	2.00	5.25
16	2.00	2.05	2.10	2.00	2.00	2.00	4.60
17	1.95	2.00	2.07	2.00	2.00	2.00	4.05
18	1.95	2.00	2.00	2.00	2.00	2.00	3.68
19	1.95	2.00	2.00	2.00	2.00	2.00	3.45
20	1.95	2.00	2.00	2.00	2.00	2.00	3.40
21	1.95	2.00	2.00	2.00	2.00	2.00	3.20
22	1.95	2.00	1.95	2.00	2.00	2.00	3.10
23	1.95	2.00	1.95	2.00	2.00	2.00	2.80
24	1.95	1.95	1.95	2.00	2.00	2.00	2.70
25	1.95	1.95	1.95	2.00	2.00	2.00	2.60
26	1.95	1.95	2.00	2.00	2.00	2.00	2.45
27	1.95	1.95	2.00	2.00	2.00	2.00	2.40
28	1.95	1.95	2.00	2.00	2.00	2.00	2.35
29	1.95	2.00	2.00	2.00	2.00	2.00	2.30
30	1.95	2.00	2.00	2.00	2.00	2.00	2.30
31	.....	2.03	2.00	.....	2.00	.....	3.48

Daily discharge, in second-feet, of Clear Creek near Winslow, Ariz., for 1906.

Day.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	3.20	70	3.36	3.45	3.86	5.5
2	.....	3.20	22	3.37	3.45	3.87	12
3	3.50	3.20	20	3.38	3.45	3.87	33
4	3.50	3.20	5	3.39	3.45	4.87	1,790
5	3.50	3.20	3	3.40	3.45	3.88	2,245
6	3.50	3.20	3	3.41	3.45	3.88	1,460
7	3.50	3.22	3	3.42	3.46	3.89	720
8	3.50	3.22	22	3.43	3.46	3.89	420
9	3.50	3.22	43	3.43	3.46	3.90	250
10	3.50	3.22	11	3.43	3.47	3.90	155
11	3.50	3.22	22	3.43	3.47	3.90	110
12	3.50	3.22	6	3.44	3.48	3.90	108
13	3.50	3.22	6	3.44	3.48	3.90	80
14	3.42	3.22	6	3.44	3.54	3.90	290
15	3.45	3.21	6	3.45	3.58	3.90	700
16	3.46	3.20	3.33	3.47	3.62	3.88	475
17	3.43	3.19	3.32	3.49	3.60	3.88	290
18	3.40	3.18	3.32	3.59	3.70	4.04	208
19	3.37	3.17	3.32	3.53	3.77	4.20	162
20	3.34	3.16	3.32	3.55	3.83	4.30	155
21	3.32	3.16	3.32	3.59	3.83	4.52	122
22	3.30	3.15	3.32	3.61	3.82	4.68	110
23	3.29	3.15	3.32	3.59	3.80	4.85	70
24	3.27	3.15	3.32	3.51	3.79	5.02	60
25	3.25	3.15	3.32	3.54	3.77	5.19	50
26	3.23	3.15	3.32	3.51	3.76	5.32	35
27	3.21	3.15	3.32	3.49	3.75	5.54	30
28	3.20	3.15	3.33	3.47	3.77	5.00	25
29	3.19	3.16	3.34	3.46	3.79	5.50	20
30	3.20	3.17	3.35	3.46	3.82	5.50	20
31	.....	3.18	3.36	.....	3.84	.....	167

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Clear Creek near Winslow, Ariz., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
June (3–30)	3.50	3.19	3.39	188
July	3.22	3.15	3.19	196
August	70.0	3.00	9.80	603
September	3.61	3.36	3.47	206
October	3.84	3.45	3.62	223
November	5.54	3.86	4.32	257
December	2,245	5.5	335	20,600
The period				22,300

WOODRUFF DITCH NEAR WOODRUFF, ARIZ.

Woodruff ditch diverts water from the north side of Little Colorado River at the point where provision is made for the overflow of the surplus water. The sill of the intake gate is slightly raised above the crest of the spillway.

This water so diverted is used to irrigate lands on the north side of the river in and about the town of Woodruff and takes practically the entire flow during the low-water season.

Measurements are made just below the canal headgate.

Discharge measurements of Woodruff Ditch near Woodruff, Ariz., by Reed and Newman, in 1906.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
August 10	1.6	16	October 3	.9	3.8
August 13	1.3	10	October 8	1.1	4.5
August 16	1.4	11	October 12	1.1	4.4
September 5	1.3	10	October 24	.8	3.8
September 6	1.3	9.8	October 26	.9	3.4
September 7		6.8	October 29	1.0	3.9
September 10	.9	5.4	October 30	.9	4.3
September 19	.9	4.4	November 2	.9	4.4
September 20	.9	4.6	November 7	.7	2.7
September 27	.9	4.6	November 12	1.0	5.2
September 28	1.7	18.9	November 20	1.0	5.3

MISCELLANEOUS MEASUREMENTS.

The following is a list of miscellaneous measurements in Little Colorado River drainage basin in 1906.

Miscellaneous measurements in Little Colorado River drainage basin, in 1906.

Date.	Stream.	Locality.	Width.	Area of section.	Discharge.
			Feet.	*Sq. ft.*	*Sec.-ft.*
May 8	West Snowflake ditch	Headgate	6	2.7	5.7
May 8	East Snowflake ditch	do	5	1.8	1.6
May 8	West Taylor ditch				1.6
May 17	Silver Creek	Dipping Vat	9	15	9.5
May 31	do	do	8	14	9.1

VIRGIN RIVER DRAINAGE BASIN.

MUDDY RIVER NEAR MOAPA, NEV.

Muddy River is a branch of the Virgin, one of the more important tributaries of the Colorado. The stream drains a long narrow strip of country in the eastern part of Lincoln County, Nev., flows southward, and joins the Virgin about 25 miles above the point where the latter stream enters the Colorado.

The gaging station was established January 1, 1904. It is located near the crossing of the San Pedro, Los Angeles and Salt Lake Railroad, about 6 miles downstream from Moapa, Nev. The station is above the Narrows and will show the amount of water available for storage at the proposed reservoir site in the Narrows. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 157, where are given also references to publications that contain data for previous years.

Discharge measurements of Muddy River near Moapa, Nev., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 24	H. H. Church	9	42	2.7	48
February 28	do	9	36	2.5	45
March 21	do	8	31	2.7	50
April 24	do	6	22	2.2	34
May 26	do	8	27	2.3	40
June 28	do	11	34	2.6	41
July 26	do	9	25	2.3	35
November 22	do	9	41	2.4	45

Daily gage height, in feet, of Muddy River near Moapa, Nev., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.7	2.6	2.5	2.5	2.3	2.3	2.5	2.2	.....	2.6	2.55	2.9
2	2.7	2.6	2.55	2.6	2.4	2.4	2.5	2.2	.....	2.6	2.6	2.9
3	2.7	2.6	2.6	2.6	2.4	2.4	2.6	2.2	.....	2.6	2.6	2.95
4	2.8	2.6	2.6	2.55	2.3	2.3	2.6	2.2	.....	2.6	2.65	3.0
5	2.8	2.55	2.6	2.55	2.2	2.3	2.7	2.2	.....	2.6	2.7	3.4
6	2.8	2.5	2.6	2.7	2.2	2.4	2.7	2.2	2.8	2.6	2.7	3.8
7	2.7	2.5	2.6	4.2	2.2	2.5	2.7	2.2	2.8	2.6	2.7	3.3
8	2.6	2.5	2.5	7.75	2.1	2.5	2.6	2.3	2.85	2.6	2.7	3.15
9	2.7	2.4	2.5	6.0	2.1	2.4	2.5	2.3	2.8	2.6	2.7	3.1
10	2.7	2.55	2.5	3.5	2.1	2.3	2.5	2.3	2.8	2.6	2.7	3.0
11	2.6	2.85	2.5	4.2	2.15	2.35	2.6	2.3	2.8	2.6	2.7	3.05
12	2.7	2.65	3.45	3.95	2.35	2.4	2.6	2.3	2.8	2.6	2.7	3.2
13	2.7	2.6	5.45	3.4	2.2	2.4	2.6	2.3	2.9	2.6	2.7	3.2
14	2.6	2.85	6.5	2.8	2.2	2.5	5.5	2.2	2.9	2.6	2.7	3.6
15	2.6	2.7	9.0	2.6	2.3	2.5	2.7	2.2	2.8	2.6	2.6	3.2
16	2.6	2.65	3.2	2.55	2.3	2.5	2.5	2.2	2.7	2.6	2.6	3.0
17	2.6	2.6	2.85	2.4	2.3	2.55	3.75	2.2	2.7	2.6	2.6	3.0
18	2.9	2.6	2.6	2.35	2.4	2.6	2.85	2.25	2.7	2.6	2.7	3.0
19	2.95	2.6	2.5	2.3	2.4	2.65	2.5	5.6	2.7	2.5	2.7	3.0
20	3.55	2.5	2.55	2.2	2.4	2.7	2.45	7.5	2.8	2.5	2.7	3.2
21	2.95	2.5	2.55	2.2	2.3	2.8	2.4	16.0	2.8	2.5	2.6	3.2
22	2.8	2.6	2.5	2.2	2.3	2.8	2.3	11.5	2.8	2.5	2.6	3.2
23	2.8	2.6	2.45	2.1	2.3	2.75	2.3	5.5	2.7	2.6	3.25	3.2
24	2.7	2.6	2.45	2.1	2.3	2.7	2.2	4.0	2.7	2.6	2.9	3.2
25	2.6	2.5	7.25	2.15	2.3	2.7	2.2	3.5	2.7	2.6	2.7	3.2
26	2.6	2.5	21.5	2.2	2.3	2.7	2.3	3.5	2.7	2.6	2.7	3.2
27	2.6	2.5	5.0	2.2	2.3	2.6	2.5	3.5	2.6	2.6	2.8	3.4
28	2.6	2.5	2.75	2.3	2.3	2.6	2.5	.....	2.6	2.5	2.85	3.4
29	2.7	.....	2.7	2.3	2.3	2.6	3.5	.....	2.6	2.5	3.0	3.4
30	2.6	.....	2.6	2.3	2.3	2.5	2.3	.....	2.6	2.5	2.9	3.45
31	2.6	.....	2.5	.....	2.3	.....	2.3	.....	.....	2.5	.....	3.5

GILA RIVER DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Gila River rises in western and southwestern New Mexico, receiving its waters from mountains having an elevation of from 7,000 to 8,000 feet. At the point where it crosses into Arizona it still has an elevation of 6,000 feet. From this place it flows between mountain ranges, falling rapidly, until at Florence, 180 miles away, it is about 1,500 feet above sea level. At a point about 15 miles above Florence the river emerges upon the plains, through which it winds for about 75 miles before receiving the waters of its principal tributary, the Salt. From the junction of the Salt the Gila continues west and southwest and enters the Colorado at Yuma, Ariz., near the southwestern corner of the Territory.

The principal tributaries are the San Pedro and Santa Cruz rivers from the south, and the San Francisco, Salt, Aqua Fria, and Hassayampa rivers from the north.

San Francisco River rises in the southwestern part of Socorro County, N. Mex., and flows southwestward into Graham County, Ariz., where it unites with the Gila. The basin comprises approximately 1,800 square miles of high, mountainous country.

Salt River, though considered a tributary of the Gila, is in fact larger both in catchment area and in discharge. It receives the drainage from central Arizona, its principal tributary, the Verde, flowing southeasterly and south from the mountains and table-lands south of Colorado River. The Verde Valley is situated in Yavapai County, Ariz., on the headwaters of the stream, and extends from a canyon above Camp Verde to a point about 10 miles below the fort. About a mile above the junction of the Verde and 30 miles above Phoenix the Salt enters upon the plains of the Gila Valley.

San Pedro River rises in the northern part of the Mexican State of Sonora, flows northward for more than 100 miles, and empties into the Gila a few miles below the town of Dudleyville, 45 miles above Florence, Ariz. Rising in a country of very light snowfall, the river depends for the greater part of its water supply on the frequent showers of the rainy seasons. It flows over a sandy bed between high, steep banks, and during the dry season it shrinks to an insignificant stream of clear water which rises and sinks in the sand with the varying depth of bed rock.

The floods of the upper Gila and its tributaries are usually short and violent, occurring during the months of January and February. The season of low water occurs in June and July.

GILA RIVER NEAR CLIFF, N. MEX.

This station was established September 9, 1904. It is located 9 miles below Cliff post-office, one-half mile below the mouth of Mancos River and 40 miles from Silver City, N. Mex. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 159, where are given also references to publications that contain data for previous years.

Discharge measurements of Gila River near Cliff, N. Mex., by Frank Asplind, in 1906.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
April 18	5.15	546	July 29	3.20	41
April 19	5.10	522	August 21 *a*	8.40	4,040
May 1	4.80	378	August 22	5.00	249
May 2	4.72	341	August 23	4.80	209
May 3	4.65	319	August 24	4.70	191
May 4	4.60	297	August 25	4.60	176
May 26	4.10	186	August 26	4.50	158
May 27	4.10	185	August 27	4.50	161
May 28	4.05	175	August 28	4.85	226
May 29	3.95	142	August 29	4.85	222
May 30	3.88	126	August 30	4.85	220
May 31	3.80	115	October 18	3.90	70
June 19	3.45	76	October 19	3.90	72
June 20	3.40	67	October 20	3.90	72
June 21	3.35	61	October 21	3.90	72
June 22	3.35	61	October 22	3.95	81
June 23	3.35	61	October 23	3.95	82
June 24	3.35	60	October 24	3.95	82
June 25	3.30	52	October 25	3.98	84
June 26	3.28	48	October 26	3.98	85
June 27	3.25	44	October 27	4.00	93
June 28	3.22	42	October 28	3.95	82
June 29	3.20	40	November 22	4.05	101
July 20	3.65	110	November 23	4.08	105
July 21	3.55	97	November 24	4.10	113
July 22	3.50	91	November 25	4.10	112
July 23	3.48	87	November 26	4.10	114
July 24	3.40	70	November 27	4.10	115
July 25	3.32	58	November 28	4.05	102
July 26	3.30	52	November 29	4.10	115
July 27	3.25	46	November 30	4.10	113
July 28	3.20	42	December 1	4.10	117

Daily gage height, in feet, of Gila River near Cliff, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.20	4.20	5.20	5.50	4.80	3.70	3.20	3.68	4.68	4.05	4.05	4.10
2	4.18	4.20	5.28	5.52	4.72	3.70	3.20	3.60	4.58	4.00	4.10	4.30
3	4.20	4.20	5.12	5.45	4.65	3.70	3.22	3.55	4.48	4.00	4.00	7.20
4	4.12	4.15	4.92	5.50	4.60	3.65	3.70	4.88	4.32	3.98	4.05	4.38
5	4.12	4.18	4.88	5.42	4.55	3.62	3.88	9.00	4.28	3.95	4.10	8.50
6	4.18	4.25	4.85	5.40	4.52	3.60	3.82	4.92	4.18	3.95	4.10	6.65
7	4.15	4.38	4.80	5.50	4.50	3.55	3.82	3.60	4.08	3.95	4.00	5.80
8	4.20	4.60	4.75	5.70	4.45	3.52	3.78	5.15	4.00	3.95	4.00	5.32
9	4.20	4.78	4.75	5.80	4.40	3.50	3.75	5.35	3.98	3.95	4.00	4.92
10	4.20	4.80	4.75	5.65	4.40	3.50	3.78	5.52	3.95	3.92	4.00	4.72
11	4.18	5.28	4.78	5.52	4.40	3.45	3.78	4.72	3.95	3.95	4.00	4.52
12	4.18	6.20	4.92	5.45	4.50	3.45	3.70	4.32	3.90	3.92	4.00	4.35
13	4.20	6.20	8.05	5.40	4.55	3.42	3.70	4.18	3.82	3.90	4.00	4.28
14	4.28	5.92	8.80	5.32	4.50	3.40	3.70	4.35	3.80	3.90	4.00	4.20
15	4.30	5.68	7.65	5.25	4.45	3.40	3.65	4.42	3.80	3.90	4.00	4.07
16	4.40	5.60	6.90	5.20	4.40	3.40	3.70	4.30	3.80	3.90	4.00	4.00
17	4.50	5.52	6.60	5.12	4.32	3.35	3.68	4.30	3.80	3.90	4.00	3.92
18	4.50	5.50	6.35	5.10	4.28	3.35	3.65	4.22	3.80	3.90	4.08	3.82
19	4.50	5.52	6.12	5.10	4.25	3.35	3.68	4.20	3.75	3.90	4.18	3.78
20	4.68	5.60	5.85	5.10	4.25	3.40	3.65	4.32	3.75	3.90	4.15	3.70

Daily gage height, in feet, of Gila River near Cliff, N. Mex., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
21	4.92	5.78	5.60	5.10	4.25	3.40	3.55	6.62	3.75	3.90	4.20	3.65
22	4.72	5.65	5.60	5.00	4.25	3.38	3.48	4.88	3.80	3.92	4.10	3.60
23	4.50	5.68	5.60	5.00	4.22	3.35	3.45	4.78	3.90	3.95	4.10	3.60
24	4.42	5.45	5.65	5.00	4.12	3.35	3.35	4.68	3.92	3.95	4.10	3.58
25	4.38	5.30	5.70	4.95	4.10	3.32	3.30	4.60	4.05	3.95	4.10	3.50
26	4.30	5.18	6.00	4.95	4.10	3.30	3.33	4.50	4.02	4.00	4.10	3.50
27	4.30	5.10	6.50	4.95	4.10	3.28	3.28	4.50	3.98	3.98	4.10	3.50
28	4.28	5.10	6.22	4.90	4.05	3.22	3.23	4.68	3.95	3.95	4.05	3.65
29	4.22	.....	6.12	4.85	3.90	3.20	3.20	4.82	3.95	3.98	4.10	6.50
30	4.20	.....	5.82	4.82	3.82	3.20	3.45	4.82	3.95	4.12	4.08	6.10
31	4.20	.....	5.52	.....	3.78	.....	3.60	4.72	.....	4.10	.....	5.76

Daily discharge, in second-feet, of Gila River near Cliff, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	204	204	566	704	382	112	32	109	189	97	97	104
2	200	204	603	713	343	112	32	96	174	90	104	132
3	204	204	529	681	318	112	35	88	163	90	90	2,394
4	186	193	437	704	300	102	112	405	121	87	97	247
5	186	200	419	667	288	99	141	5,250	129	83	104	4,175
6	200	216	405	658	283	96	131	437	115	83	104	1,640
7	193	247	382	704	276	88	131	96	101	83	90	575
8	204	300	359	800	258	83	125	543	90	83	90	338
9	204	373	359	860	252	80	120	635	87	83	90	230
10	204	382	359	773	252	80	125	713	83	79	90	195
11	200	603	373	713	252	72	125	345	83	83	90	165
12	200	1,140	437	681	276	72	112	233	76	79	90	139
13	204	1,140	3,380	658	288	67	112	199	65	76	90	129
14	222	944	4,850	621	276	64	112	240	62	76	90	118
15	228	790	2,725	589	258	64	104	257	62	76	90	100
16	252	750	1,820	566	252	64	112	228	62	76	90	90
17	276	713	1,460	529	232	56	109	228	62	76	90	79
18	276	704	1,250	520	224	56	104	209	62	76	101	65
19	276	713	1,084	520	216	56	109	204	60	76	115	60
20	329	750	895	520	216	64	104	233	60	76	109	55
21	437	848	750	520	216	64	88	1,600	60	76	118	48
22	345	775	750	474	216	63	77	223	62	79	104	45
23	276	790	750	474	209	56	72	206	76	83	104	45
24	256	681	775	474	187	56	56	189	79	83	104	42
25	247	612	800	451	182	51	48	178	97	83	104	36
26	228	557	1,000	451	182	48	53	163	93	90	104	36
27	228	520	1,370	431	182	45	45	163	87	87	104	36
28	222	520	1,154	428	171	35	37	189	83	76	97	48
29	208	.....	1,105	405	144	32	32	211	83	87	104	1,435
30	204	.....	874	391	134	32	72	211	83	107	101	887
31	204	.....	713	.....	125	.....	96	196	.....	104	.....	549

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Gila River near Cliff, N. Mex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	437	186	236	14,500
February	1,140	193	574	31,900
March	4,850	359	1,060	65,200
April	860	391	590	35,100
May	382	125	238	14,600
June	112	32.0	69.4	4,130
July	141	32.0	89.1	5,480
August	5,250	88.0	461	28,300
September	189	60.0	90.3	5,370
October	107	76.0	83.3	5,120
November	118	90.0	98.5	5,860
December	4,180	36.0	459	28,200
The year	5,250	32.0	337	244,000

GILA RIVER AT DOME (GILA CITY), ARIZ.

This station was established October 15, 1903. It is located 20 miles above the junction of the Gila with the Colorado. The point of gaging first established was one-fourth mile north of the depot at Dome. The river now flows in a channel fully 1 mile north of the original channel.

The Gila carries an enormous amount of mud and sand. At times the waves of sand traveling along the bed of the stream are so large, the current is so swift, and the stream so shallow, that the water is broken into a uniform succession of waves 2 feet high and over. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 164, where are given also references to publications that contain data for previous years.

Discharge measurements of Gila River at Dome, Ariz., in 1906.

Date.	Hydrographer.	Gage height.	Discharge.
		Feet.	*Sec.-ft.*
January 6	W. D. Smith	6.80	1,550
January 24	do	7.95	4,950
Febuary 16	do	9.40	[a] 7,500
February 18	do	7.65	4,560
March 15	do	12.50	[a] 55,000
March 29	do	12.00	[a] 45,000
May 6	do	7.55	1,590
June 12	do	5.00	27
August 23	do	5.30	64

[a] Estimated from gage heights at Yuma, Laguna, and Dome, and from measured discharge at Yuma.

Daily gage height, in feet, of Gila River at Dome, Ariz., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	7.2	7.3		9.0	8.0							
2	7.0		7.5			5.5			5.5			
3	7.0	7.0		8.8	7.9							
4	6.9		7.4			5.4			5.3			
5		7.0		8.6	7.8							10.1
6	6.8		7.6			5.3			5.2			
7		6.9		8.4	7.6							11.0
8	6.9		7.4			5.2			5.15			
9		6.8		8.8	7.4							9.5
10	6.8		7.1	10.0		5.1			5.1			
11		6.8		9.4	7.2							8.0
12	6.7		6.8			5.0			5.0			
13		6.9		8.9	7.1							7.1
14	6.6		6.7			4.9			4.8			
15		7.6	12.5	8.8	7.0							6.0
16	6.6	9.45	10.5			4.8						
17		7.9	9.5	8.5	6.8							6.9
18	6.6	7.6	8.5			4.7		6.0				
19			8.5	8.4	6.55			5.5				6.75
20	6.6	7.6	8.0			4.7		7.0				
21				8.3	6.25			6.0				6.55
22	6.6	7.5	8.0			4.7		5.6				
23	8.55			8.25	6.0			5.3				6.4
24	8.0	7.9	7.8			4.7		5.0				
25	7.7		7.6	8.2	5.9			5.0				6.25
26	7.5	7.7				4.7						
27			9.4	8.15	5.8			7.0				6.1
28	7.4	7.7	11.9			4.7						
29			12.0	8.1	5.7			6.6				6.0
30	7.5		9.25			4.7						
31			9.0		5.6			6.0				10.0

NOTE.—River dry June 17 to August 17 and September 15 to December 4.

Daily discharge, in second-feet, of Gila River at Dome, Ariz., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2,400	2,600	3,250	9,200	4,400	380	0	0	550	0	0	0
2	2,000	2,300	3,000	8,600	4,240	340	0	0	340	0	0	0
3	2,000	2,000	2,900	8,000	4,090	300	0	0	260	0	0	0
4	1,850	2,000	2,800	7,440	3,940	260	0	0	190	0	0	0
5	1,780	2,000	3,020	6,890	3,790	220	0	0	160	0	0	17,900
6	1,720	1,920	3,240	6,420	3,520	190	0	0	120	0	0	23,400
7	1,780	1,850	3,020	5,940	3,240	160	0	0	110	0	0	29,000
8	1,850	1,780	2,800	6,970	3,000	120	0	0	100	0	0	20,800
9	1,780	1,720	2,500	8,000	2,800	90	0	0	100	0	0	12,600
10	1,720	1,720	2,190	16,800	2,600	80	0	0	100	0	0	8,500
11	1,660	1,720	1,860	11,800	2,400	60	0	0	70	0	0	4,400
12	1,600	1,780	1,720	10,200	2,300	40	0	0	40	0	0	3,300
13	1,540	1,850	1,660	8,500	2,190	30	0	0	20	0	0	2,190
14	1,470	2,540	1,600	8,250	2,100	20	0	0	10	0	0	1,480
15	1,470	3,240	54,600	8,000	2,000	20	0	0	0	0	0	760
16	1,470	11,800	22,500	7,200	1,840	10	0	0	0	0	0	1,300
17	1,470	4,090	12,600	6,400	1,720	0	0	0	0	0	0	1,850
18	1,470	3,240	6,400	6,170	1,560	0	0	760	0	0	0	1,760
19	1,470	3,240	6,400	5,940	1,410	0	0	340	0	0	0	1,660
20	1,470	3,240	4,400	5,720	1,230	0	0	2,000	0	0	0	1,540
21	1,470	3,120	4,400	5,510	1,050	0	0	760	0	0	0	1,410
22	1,470	3,000	4,400	5,400	900	0	0	420	0	0	0	1,320
23	6,640	3,540	4,100	5,300	760	0	0	190	0	0	0	1,230
24	4,400	4,090	3,790	5,200	710	0	0	40	0	0	0	1,140
25	3,500	3,800	3,240	5,100	670	0	0	40	0	0	0	1,050
26	3,000	3,500	7,520	5,000	630	0	0	1,020	0	0	0	960
27	2,900	3,500	11,800	4,910	590	0	0	2,000	0	0	0	870
28	2,800	3,500	43,500	4,820	540	0	0	1,740	0	0	0	810
29	2,900	.....	45,200	4,730	500	0	0	1,470	0	0	0	760
30	3,000	.....	10,800	4,560	460	0	0	1,120	0	0	0	8,780
31	2,800	.....	9,200	.....	420	.....	0	760	.....	0	.....	16,800

NOTE.—The above daily discharges have been obtained from an approximate rating table.

Monthly discharge of Gila River at Dome, Ariz., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	6,640	1,470	2,220	136,000
February	11,800	1,720	3,020	168,000
March	54,600	1,600	9,370	576,000
April	16,800	4,560	7,100	422,000
May	4,400	420	1,990	122,000
June	380	0	77	4,580
July	0	0	0	0
August	2,000	0	408	25,100
September	550	0	72	4,280
October	0	0	0	0
November	0	0	0	0
December	29,000	0	5,400	332,000
The year	54,600	0	2,470	1,790,000

SAN FRANCISCO RIVER AT ALMA, N. MEX.

This station was established October 18, 1904. It is located about one-half mile south of Alma, N. Mex., and 85 miles northwest of Silver City. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 166, where are given also references to publications that contain data for previous years.

Discharge measurements of San Francisco River at Alma, N. Mex., by F. Asplind, in 1906.

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
January 1	1.40	19
January 3	1.48	30
January 4	1.40	21
January 5	1.45	28
January 8	1.45	28
January 16	1.52	39
January 17	1.55	41
January 18	1.58	48
January 19	1.60	50
January 20	2.32	214
January 22	1.65	63
January 23	1.60	49
January 25	1.65	59
January 26	1.65	60
January 27	1.60	49
January 29	1.62	55
January 30	1.60	52
February 2	1.62	55
February 3	1.60	54
February 5	1.65	64
February 6	1.78	101
February 7	1.90	141
February 8	2.02	180
February 9	2.15	236
February 10	2.10	208
February 13	2.40	315
February 14	2.10	212
February 16	2.10	210
February 21	2.30	275
February 22	2.55	390
February 23	2.50	373
February 24	2.30	275
February 26	2.18	240
February 27	2.25	252
March 1	2.50	363
March 3	2.15	219
March 5	2.10	209
March 7	2.10	203
March 8	2.15	224
March 9	2.25	268
March 10	2.30	285
March 12	2.45	321
March 13	4.30	1,250
March 14 [a]	5.20	2,080
March 15	4.00	1,080
March 16	3.40	830
March 17	3.05	599
March 20	2.70	428
March 21	2.65	393
March 23	2.70	421
March 27	3.45	867
March 28	3.20	701
March 29	2.95	582
March 30	2.80	500
April 2	2.50	357
April 3	2.40	302
April 4	2.35	283
April 5	2.30	260
April 6	2.50	348
April 7	2.75	441
April 9	2.35	282
April 11	2.30	259
April 24	1.95	182
April 26	1.90	164
April 28	1.85	149
May 7	1.60	84
May 9	1.55	70
May 11	1.48	53
May 12	1.45	50
May 14	1.45	49
May 15	1.40	37
May 16	1.35	30
May 18	1.30	24
May 19	1.30	25
May 21	1.30	24
May 23	1.20	17
June 2	1.10	14
June 4	1.10	13
June 6	1.00	8
June 7	1.00	8
June 8	.98	8
June 9	.98	7
June 11	.90	3
June 13	.90	3
June 14	.90	4
June 16	.88	2
July 2	0.88	1
July 3	.88	1
July 6	1.35	34
July 7	1.30	31
July 9	1.10	13
July 10	.92	4
July 12	.90	4
July 13	1.08	10
July 14	.98	6
July 16	1.42	48
July 17	1.75	127
July 18	1.50	66
August 1	1.20	11
August 3	1.15	9.0
August 4	1.10	5.6
August 6	1.20	13
August 7	2.20	208
August 8	1.20	13
August 10	2.90	576
August 11	1.40	38
August 13	1.25	21
August 14	1.80	124
August 15	1.35	34
August 16	1.55	62
August 17	1.30	26
August 18	1.25	21
September 4	1.20	15
September 5	1.20	15
September 7	1.10	10
September 8	1.08	8.9
September 10	1.05	7.5
September 11	1.00	5.7
September 12	1.00	6.7
September 13	1.00	7.4
September 14	2.68	397
September 15	1.50	54
September 17	1.30	25
September 18	1.25	18
September 19	1.15	9.5
September 20	1.20	13
September 21	1.10	5.2
September 22	1.10	5.1
September 24	1.15	7.5
September 25	1.25	16
September 26	1.30	23
September 27	1.25	19
September 28	1.25	17
October 1	1.20	16
October 2	1.20	16
October 3	1.15	8.3
October 5	1.15	11
October 6	1.10	6.0
October 8	1.12	9.4
October 9	1.10	6.4
October 10	1.10	6.7
October 12	1.15	12
October 13	1.15	11
October 15	1.15	10
November 1	1.20	15
November 2	1.35	30
November 3	1.25	18
November 5	1.22	16
November 7	1.22	16
November 8	1.20	15
November 9	1.20	15
November 10	1.20	14
November 12	1.18	10
November 13	1.20	14
November 14	1.20	14
November 15	1.20	14
November 17	1.20	13
November 19	1.20	14
December 3	6.30	3,050

[a] Float measurement.

Discharge measurements of San Francisco River at Alma, N. Mex., by F. Asplind, in 1906—Continued.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
December 3[a]	13.40	21,000	December 22	1.10	48
December 13	1.70	176	December 24	1.05	36
December 14	1.65	159	December 26	1.05	36
December 15	1.45	111	December 27	1.05	36
December 17	1.30	81	December 28	3.08	734
December 18	1.25	70	December 29[a]	4.15	1,414
December 21	1.15	56			

[a] Float measurement.

Daily gage height, in feet, of San Francisco River at Alma, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.42	1.60	2.40	2.60	1.70	1.05	0.90	1.90	1.35	1.30	1.30	1.45
2	1.42	1.60	2.40	2.52	1.70	1.05	.90	1.55	1.32	1.25	1.30	3.65
3	1.42	1.60	2.30	2.50	1.70	1.00	.95	1.35	1.30	1.20	1.25	5.75
4	1.42	1.60	2.30	2.48	1.60	1.00	1.30	1.35	1.22	1.18	1.25	8.00
5	1.42	1.65	2.20	2.40	1.60	1.00	1.30	1.30	1.18	1.10	1.20	5.15
6	1.42	1.68	2.20	2.42	1.55	1.00	1.30	1.42	1.12	1.10	1.20	4.30
7	1.48	1.90	2.05	2.52	1.50	1.00	1.20	1.85	1.10	1.10	1.20	3.85
8	1.48	2.02	2.00	2.45	1.50	1.00	1.18	1.30	1.08	1.20	1.20	3.55
9	1.48	2.08	2.01	2.45	1.50	1.00	1.13	1.30	1.00	1.20	1.20	2.70
10	1.50	2.10	2.25	2.40	1.45	0.90	1.10	2.08	1.00	1.15	1.20	2.20
11	1.50	2.52	2.25	2.38	1.42	0.90	1.10	1.60	1.00	1.15	1.20	1.95
12	1.50	2.65	2.45	2.30	1.40	0.90	1.00	1.30	1.00	1.15	1.20	1.80
13	1.52	2.42	4.65	2.22	1.4	0.90	.95	1.3	1.15	1.10	1.20	1.68
14	1.52	2.22	5.15	2.20	1.40	0.85	0.92	1.45	2.35	1.10	1.20	1.45
15	1.52	2.10	3.78	2.12	1.40	0.85	0.90	1.52	2.00	1.10	1.20	1.40
16	1.52	2.10	3.30	2.10	1.35	0.85	1.22	1.55	2.00	1.10	1.20	1.35
17	1.55	2.00	3.00	2.00	1.35	0.85	1.68	1.40	1.90	1.10	1.20	1.30
18	1.58	2.05	2.82	2.00	1.35	0.85	1.48	1.30	1.88	1.10	1.20	1.25
19	1.60	2.15	2.72	2.00	1.30	0.85	1.40	1.28	1.70	1.10	1.20	1.20
20	2.15	2.35	2.68	2.00	1.25	0.85	1.50	1.28	1.60	1.10	1.30	1.20
21	1.68	2.40	2.60	1.95	1.25	0.85	1.25	1.40	1.48	1.15	1.38	1.20
22	1.68	2.45	2.70	1.95	1.20	0.85	1.10	1.60	1.28	1.15	1.40	1.15
23	1.60	2.52	2.70	1.92	1.30	0.85	1.05	1.75	1.12	1.20	1.40	1.10
24	1.60	2.35	2.70	1.90	1.30	0.85	1.05	1.38	1.35	1.20	1.40	1.10
25	1.60	2.20	2.65	1.90	1.30	0.85	1.02	1.40	2.00	1.20	1.40	1.05
26	1.60	2.25	2.75	1.90	1.30	0.85	1.40	1.35	1.50	1.20	1.40	1.05
27	1.60	2.35	3.80	1.85	1.20	0.85	1.50	1.90	1.35	1.20	1.40	1.05
28	1.60	2.40	3.15	1.80	1.18	0.85	1.70	1.85	1.25	1.20	1.40	1.88
29	1.60	.....	2.95	1.78	1.10	0.85	1.45	1.90	1.45	1.20	1.40	3.75
30	1.60	.....	2.75	1.70	1.10	0.85	1.35	1.50	1.30	1.20	1.40	2.65
31	1.60	.....	2.60	.....	1.05	.....	1.33	1.40	.....	1.20	.....	1.98

Daily discharge, in second-feet, of San Francisco River at Alma, N. Mex., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	23	52	325	405	113	11	2	150	29	23	23	111
2	23	52	325	370	113	11	2	65	25	19	23	1,097
3	23	52	280	350	113	8	5	29	23	15	19	2,627
4	23	52	280	300	84	8	31	29	14	13	19	4,345
5	23	64	240	300	84	8	31	23	11	7	15	2,169
6	23	70	240	310	70	8	31	39	12	7	15	1,520
7	33	137	186	330	55	8	22	130	10	7	15	1,227
8	33	177	170	318	55	8	21	23	9	15	15	1,032
9	33	196	173	325	55	8	16	23	4	15	15	530
10	36	203	260	305	46	8	14	181	5	11	15	320
11	36	379	250	295	41	3	14	75	6	11	15	232
12	36	438	325	265	37	3	8	23	7	11	15	195
13	39	334	1,578	235	37	3	5	23	21	7	15	165
14	39	248	2,040	235	37	3	4	45	232	7	15	110
15	39	203	980	210	37	1	3	59	163	7	15	101

Daily discharge, in second-feet, of San Francisco River at Alma, N. Mex., for 1906—Continued.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
16	39	203	770	210	31	1	24	65	163	7	15	90
17	44	170	575	180	31	1	110	35	141	7	15	81
18	49	186	485	175	31	1	62	23	137	7	15	72
19	52	222	435	185	25	1	45	21	97	7	15	63
20	222	302	425	190	21	1	66	21	75	7	23	63
21	70	325	370	175	21	1	26	35	51	11	29	63
22	70	348	420	180	17	1	14	75	21	11	36	54
23	52	379	421	170	25	1	11	108	6	15	36	46
24	52	302	445	165	25	1	11	33	29	15	36	46
25	52	240	440	165	25	1	9	35	163	15	36	38
26	52	260	515	164	25	1	45	29	55	15	36	38
27	52	302	1,038	150	17	1	66	141	29	15	36	38
28	52	325	675	135	14	1	116	130	17	15	36	215
29	52	.....	585	130	11	1	55	141	45	15	36	1,162
30	52	.....	475	105	11	1	38	55	23	15	36	505
31	52	.....	405	.....	8	.....	35	35	.....	15	.....	244

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of San Francisco River at Alma, N. Mex., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
1907.				
January	222	23	47.6	2,930
February	438	52	222	12,300
March	2,040	170	520	32,000
April	405	105	234	13,900
May	113	8	42.4	2,610
June	11	1	3.8	226
July	116	2	30.4	1,870
August	181	21	61.3	3,770
September	232	4	54.1	3,220
October	23	7	11.8	726
November	36	15	22.8	1,360
December	4,340	38	600	36,900
The year	4,340	1	154	112,000

SAN PEDRO RIVER AT CHARLESTON, ARIZ.

This station was established January 22, 1904, and was discontinued September 6, 1906. It is located on the El Paso and Southwestern Railroad about one-half mile west of Charleston station and 6 miles south of Fairbank, Ariz. The conditions and the bench marks are described in Water-Supply Paper No. 175, page 170, where are given also references to publications that contain data for previous years.

On February 23, 1906, the cable was moved 70 feet upstream, where channel conditions are the same. The initial point is the first tag on a wire at the face of the cable support on the right bank. A wash comes in just below the station, but carries water only in time of heavy rain and then only for a few hours. The amount carried can be easily measured.

Discharge measurements of San Pedro River at Charleston, Ariz., by Rayling, Reed, and McGee, in 1906.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
January 3	25.4	58	April 24	25.0	26
January 10	25.3	65	April 30	25.0	25
January 17	25.4	59	May 16	25.0	18
January 24	25.4	49	May 24	24.9	16
January 31	25.4	50	May 31	24.9	14
February 17	25.95	164	June 5	24.9	10
February 20	25.5	83	June 13	24.9	9.2
February 24	25.6	65	June 28	24.8	4.1
March	25.4	44	August 11	25.5	50
April 8	25.3	33	August 18	26.5	13
April 16	25.2	29	August 28	25.2	50

Daily gage height, in feet, of San Pedro River at Charleston, Ariz., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	25.4	25.35	25.4	25.3	25.0	24.9	25.2	25.5
2	25.4	25.35	25.4	25.3	25.0	24.9	25.2	25.5
3	25.4	25.3	25.4	25.3	25.0	24.9	25.2	25.5
4	25.4	25.15	25.4	25.3	25.0	24.9	25.2	25.5
5	25.4	25.15	25.4	25.3	25.0	24.9	25.2	27.7
6	25.4	25.2	25.3	25.3	25.0	24.9	25.2	26.7
7	25.4	25.45	25.3	25.3	25.0	24.9	25.2	26.5
8	25.4	25.55	25.3	25.3	25.0	24.9	25.4	26.9
9	25.4	25.75	25.4	25.3	25.0	24.9	25.4	26.6
10	25.4	25.85	25.3	25.3	25.0	24.9	25.4	25.5
11	25.4	26.15	25.3	25.3	25.0	24.9	25.4	25.5
12	25.4	25.95	25.3	25.2	25.0	24.9	25.4	26.5
13	25.4	28.5	25.5	25.2	25.0	24.9	25.4	25.75
14	25.4	27.3	26.7	25.2	25.0	24.9	25.4	25.45
15	25.4	27.1	25.6	25.2	25.0	24.9	25.4	25.3
16	25.4	26.0	25.5	25.2	25.0	24.9	25.4	29.9
17	25.4	25.8	25.5	25.2	25.0	24.9	25.2	26.7
18	25.4	25.1	25.5	25.0	25.0	24.9	25.2	26.5
19	25.4	25.6	25.5	25.0	24.9	24.9	25.2	25.2
20	25.4	25.5	25.5	25.0	24.9	24.9	25.2	26.5
21	25.4	25.5	25.4	25.0	24.9	24.9	25.6	27.3
22	25.4	25.5	25.4	25.0	24.9	24.9	25.6	26.5
23	25.4	25.5	25.4	25.0	24.9	24.9	25.6	25.4
24	25.4	25.5	25.4	25.0	24.9	24.9	25.4	25.2
25	25.4	25.5	25.4	25.0	24.9	24.9	25.4	25.2
26	25.4	25.5	25.3	25.0	24.9	24.9	25.8	25.2
27	25.4	25.5	25.3	25.0	24.9	24.9	25.8	25.2
28	25.4	25.5	25.3	25.0	24.9	24.9	25.6	25.2
29	25.4	.....	25.3	25.0	24.9	24.9	25.6	25.2
30	25.4	.....	25.3	25.0	24.9	24.9	25.6	25.5
31	25.4	.....	25.3	.....	24.9	.....	25.6	26.6

Daily discharge, in second-feet, of San Pedro River at Charleston, Ariz., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
1	58	40	60	33	25	4	20	40
2	58	40	60	33	24	6	20	40
3	58	28	60	33	24	7	21	40
4	59	20	60	33	23	9	22	40
5	60	20	60	33	23	10	23	519
6	61	24	36	33	22	10	23	316
7	62	60	36	33	21	10	24	174
8	63	80	36	33	21	10	25	358
9	64	123	45	33	20	10	25	194
10	65	144	36	33	20	10	25	50

Daily discharge, in second-feet, of San Pedro River at Charleston, Ariz., for 1906—Cont'd.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
11	64	205	36	33	19	10	25	50
12	63	164	36	30	19	10	25	174
13	62	678	55	30	18	10	25	126
14	61	438	316	30	18	9	25	71
15	60	398	298	30	18	9	25	47
16	59	174	55	30	17	9	25	958
17	58	154	55	30	17	9	25	316
18	57	120	55	25	17	9	25	13
19	56	100	55	25	17	9	25	50
20	55	83	55	25	17	8	25	120
21	54	78	60	25	17	8	45	162
22	53	74	60	25	17	8	47	120
23	52	70	60	25	17	7	49	34
24	51	65	60	25	17	7	51	50
25	50	65	60	25	17	7	53	50
26	49	65	36	25	17	6	55	50
27	49	65	36	25	17	6	55	50
28	49	65	36	25	16	4	45	50
29	49	.....	36	25	15	4	45	50
30	49	.....	36	25	15	4	45	55
31	50	.....	36	.....	14	.....	45	194

NOTE.—These discharges were obtained by the indirect method for shifting channel.

Monthly discharge of San Pedro River at Charleston, Ariz., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	65	49	56.7	3,490
February	578	20	130	7,220
March	316	36	65.2	4,010
April	33	25	28.9	1,720
May	25	14	18.7	1,150
June	10	4	8.0	476
July	55	20	32.7	2,010
August	958	13	147	9,040
The period	.....	.....	.....	29,100

SALT RIVER AT ROOSEVELT, ARIZ.

This station was established February 7, 1901. It is located at the town of Roosevelt, which is the United States Reclamation Service construction camp for the Salt River dam and reservoir, and is about 12 miles west of Livingston, Ariz. The conditions at this station are described in Water-Supply Paper No. 175, page 173, where are given also references to publications that contain data for previous years.

During September, 1906, this station was reequipped with a cable and car at a point about 500 feet below the Roosevelt dam site.

During the flood of December 3 to 5, 1906, the gage rod which had been in use since the construction on the dam was begun, was carried away. From December 3 to 15, 1906, the readings were taken on the upper gage about 1,000 feet above the dam. A new rod was established at the same location as the one carried away, on December 17, 1906, with the zero at the same elevation as the old gage.

Discharge measurements of Salt River, at Roosevelt, Ariz., by Blades, Stone, and McIntyre, in 1906.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1906.	*Feet.*	*Sec.-ft.*	1906.	*Feet.*	*Sec.-ft.*
anuary 6	6.60	883	April 28	8.75	3,030
anuary 8	6.70	863	April 30	8.55	2,710
anuary 9	6.70	887	May 1	8.45	2,650
anuary 10	6.70	864	May 2	7.95	2,360
anuary 11	6.70	865	May 3	7.80	2,200
anuary 12	6.60	753	May 4	7.70	2,230
anuary 13	6.60	795	May 5	7.55	2,100
anuary 15	6.70	876	May 7	7.40	2,000
anuary 16	6.90	1,060	May 8	7.40	1,980
anuary 17	7.25	1,580	May 9	7.35	1,900
anuary 18	7.40	1,760	May 10	7.30	1,980
anuary 19	7.30	1,540	May 11	7.20	1,830
anuary 20	9.30	2,190	May 12	7.20	1,910
anuary 21	10.65	8,900	May 14	7.35	1,960
anuary 22	8.65	3,130	May 15	7.20	1,880
anuary 23	7.80	2,320	May 16	6.95	1,770
anuary 24	7.40	1,720	May 17	6.70	1,620
anuary 25	7.20	1,560	May 18	6.80	1,730
anuary 26	7.00	1,360	May 19	6.50	1,560
anuary 27	6.90	1,230	May 21	6.70	1,380
anuary 29	6.65	1,040	May 22	7.20	1,520
anuary 30	6.60	938	May 23	7.50	1,370
anuary 31	6.50	949	May 26	7.50	1,240
ebruary 1	6.50	903	May 28	7.35	1,110
ebruary 2	6.50	902	May 29	7.20	985
ebruary 3	6.50	863	May 31	7.20	966
ebruary 5	6.50	863	June 1	7.20	960
ebruary 6	6.55	947	June 2	7.20	955
ebruary 7	6.70	1,090	June 4	7.20	854
ebruary 8	6.80	1,230	June 5	7.15	879
ebruary 9	6.80	1,210	June 6	7.00	851
ebruary 10	6.80	1,260	June 7	7.00	828
ebruary 12	7.35	1,730	June 8	6.90	843
ebruary 13	8.00	2,970	June 9	6.90	832
ebruary 14	7.85	2,490	June 11	6.95	770
ebruary 15	7.45	2,130	June 12	7.20	757
ebruary 16	7.30	1,750	June 13	7.20	770
ebruary 17	7.20	1,640	June 14[a]	8.40	733
ebruary 19	7.10	1,410	June 15	8.40	642
ebruary 20	7.05	1,370	June 19	9.30	644
ebruary 21	7.10	1,460	June 20	9.05	603
ebruary 23	7.20	1,540	June 21	8.90	564
ebruary 24	7.25	1,590	June 22	8.75	533
arch 5	7.15	1,650	June 23	8.55	495
arch 6	7.15	1,570	June 25	8.40	404
arch 7	7.10	1,530	June 26	8.35	428
arch 8	7.15	1,480	June 27	8.75	422
arch 9	7.15	1,490	June 29	8.20	385
arch 10	7.20	1,640	July 6[b]	2.40	473
arch 12	8.95	1,950	July 17[b]	2.70	812
arch 16	10.80	10,200	July 31	2.40	405
arch 17	10.35	7,330	August 2	2.40	427
arch 19	9.65	5,530	August 4	2.40	439
arch 20	9.35	4,580	August 5	2.40	457
arch 21	9.25	3,560	August 8	2.60	702
arch 22	9.00	3,480	August 9	3.10	1,390
arch 23	9.05	3,280	August 11	2.60	768
arch 24	9.20	3,650	August 13	2.50	646
arch 26	11.70	10,100	August 16	2.60	650
arch 28	13.35	16,800	August 18	2.60	703
arch 30	10.50	8,830	August 20[c]	3.70	2,040
pril 2	10.40	6,550	August 22[c]	3.75	2,120
pril 9	10.70	7,360	August 23[c]	3.11	927
pril 10	10.15	5,950	August 24	2.70	730
pril 11	9.95	5,500	August 27	2.60	670
pril 12	9.90	5,330	August 28	2.60	887
pril 13	9.75	5,690	September 1	2.50	797
pril 14	9.60	4,960	September 3	2.40	635
pril 16	9.40	4,710	September 14	2.30	264
pril 17	9.30	4,080	September 15	2.30	372
pril 18	9.30	4,040	September 17	2.40	642
pril 19	9.30	3,900	September 18	2.40	438
pril 20	9.30	3,990	September 18	2.40	409
pril 21	9.20	3,830	September 20	2.38	323
pril 23	9.3	3,840	September 21	2.30	318
pril 24	9.2	3,930	September 25	2.30	286
pril 25	9.2	3,960	September 28	2.40	409
pril 27	9.0	3,240	September 30	2.40	434

[a] Cofferdam being filled in. [b] Measurement made by P. P. Pitchlynn. [c] Float measurements.

Discharge measurements of Salt River, at Roosevelt, Ariz., by Blades, Stone, and McIntyre, in 1906—Continued.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1906.	*Feet.*	*Sec.-ft.*	1906.	*Feet.*	*Sec.-ft.*
October 2	2.30	416	October 27	2.35	288
October 3	2.35	426	November 1	2.35	270
October 7	2.30	318	December 14	.....	1,330
October 9	2.30	348	December 15	3.48	1,250
October 11	2.30	311	December 16	3.35	1,070
October 13	2.30	276	December 17	3.35	1,060
October 15	2.30	258	December 18	3.30	824
October 16	2.30	264	December 19	3.10	794
October 17	2.30	268	December 21	2.75	686
October 18	2.27	282	December 22	2.70	630
October 20	2.25	263	December 29	10.80	17,600
October 23	2.30	258			

Daily gage height, in feet, of Salt River at Roosevelt, Ariz., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	6.7	6.5	7.2	10.3	8.45	7.2	2.3	2.4	2.5	2.3	2.35	2.58
2	6.7	6.5	7.35	10.4	7.95	7.2	2.3	2.4	2.5	2.3	2.32	3.38
3	6.7	6.5	7.35	10.3	7.8	[a] 7.2	2.3	2.5	2.4	2.35	2.3	[c] 25.34
4	6.6	6.5	7.2	9.95	7.7	7.2	2.3	2.4	2.4	2.3	2.28	[c] 22.45
5	6.6	6.5	7.15	9.75	7.55	7.15	2.7	2.4	2.4	2.35	2.25	[c] 15.26
6	6.6	6.55	7.15	9.55	[a] 7.5	7.0	2.4	3.0	2.4	2.35	2.32	[c] 12.1
7	6.7	6.7	7.1	11.15	7.4	7.0	2.5	2.75	2.4	2.3	2.38	7.25
8	6.7	6.8	7.15	11.8	7.4	6.9	2.4	2.6	2.4	2.3	2.22	5.57
9	6.7	6.8	7.15	10.7	7.35	6.9	2.4	3.1	2.4	2.3	2.3	5.0
10	6.7	6.8	7.2	10.15	7.3	[a] 6.9	2.4	2.6	2.4	2.3	2.3	.....
11	6.7	7.0	7.3	9.95	7.2	6.95	2.5	2.6	2.3	2.3	2.25	.....
12	6.6	7.35	10.3	9.9	7.2	7.2	2.5	2.5	2.3	2.3	2.3	.....
13	6.6	8.0	19.4	9.75	[a] 7.3	7.2	2.5	2.5	2.3	2.3	2.4	.....
14	6.6	7.85	17.6	9.6	7.35	[b] 8.4	2.5	2.5	2.3	2.3	2.38	.....
15	6.7	7.45	12.05	[a] 9.5	7.2	8.65	2.4	2.5	2.3	2.28	2.3	3.48
16	6.9	7.3	10.8	9.45	6.95	8.8	2.5	2.6	2.4	2.3	2.38	3.35
17	7.25	7.2	10.35	9.3	6.7	[a] 8.8	2.7	2.6	2.4	2.35	2.48	3.35
18	7.4	7.1	9.8	9.3	6.8	9.4	2.3	2.6	2.4	2.3	2.42	3.02
19	7.3	7.1	9.65	9.3	6.5	9.3	2.4	3.25	2.4	2.3	2.3	2.74
20	9.3	7.05	9.35	9.35	[a] 6.5	9.05	2.4	3.7	2.4	2.25	2.28	2.72
21	10.65	7.1	9.25	9.2	6.7	8.9	2.4	3.3	2.3	2.25	2.3	2.73
22	8.65	7.1	9.0	[a] 9.2	7.2	8.75	2.3	3.75	2.3	2.3	2.4	2.74
23	7.8	7.2	9.05	9.3	7.5	8.55	2.5	2.75	2.3	2.25	2.48	2.72
24	7.4	7.25	9.25	9.25	7.3	8.45	2.5	2.7	2.3	2.25	2.5	2.65
25	7.2	7.15	9.45	9.25	7	8.4	2.4	2.7	2.3	2.25	2.58	2.65
26	7.0	7.1	13.5	9.25	7.5	8.35	2.4	2.7	2.3	2.3	2.65	2.55
27	6.9	7.0	17.0	9.05	[a] 7.4	8.25	2.8	2.6	2.3	2.3	2.45	2.45
28	6.8	7.0	13.25	8.75	7.35	8.2	2.7	2.6	2.3	2.3	2.38	4.78
29	6.65	.....	11.4	[a] 8.6	7.2	8.2	2.55	2.6	2.4	2.28	2.4	11.55
30	6.6	.....	10.5	8.55	[a] 7.2	8.2	2.5	2.55	2.4	2.35	2.4	9.15
31	6.5	.....	10.05	.....	7.2	.....	2.5	2.5	.....	2.3	.....	7.25

[a] Gage heights estimated.
[b] Cofferdam being filled.
[c] Mean of readings at two-hour intervals.

Daily discharge, in second-feet, of Salt River at Roosevelt, Ariz., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	990	903	1,610	7,950	2,652	960	385	417	797	425	270	305
2	990	903	1,730	6,547	2,365	955	385	427	797	416	267	430
3	990	863	1,730	6,685	2,201	905	385	575	635	426	265	36,600
4	880	863	1,610	5,828	2,229	854	385	427	635	399	263	33,700
5	880	863	1,648	5,337	2,095	879	765	455	635	372	260	8,800
6	883	947	1,572	4,847	2,092	850	475	1,275	635	345	267	5,200
7	920	1,092	1,534	8,767	1,997	828	570	927	635	318	275	4,000
8	863	1,234	1,481	10,518	1,982	843	475	725	635	330	257	1,900
9	887	1,236	1,488	7,362	1,899	832	475	1,415	635	348	265	1,650
10	864	1,258	1,638	5,953	1,982	815	475	715	635	315	265	1,400
11	865	1,410	1,718	5,505	1,832	770	570	715	264	311	260	1,300
12	753	1,732	6,685	5,330	1,907	757	570	575	264	290	265	1,300
13	795	2,974	35,700	5,686	1,954	770	570	645	264	276	280	1,326
14	790	2,494	30,000	4,836	1,957	733	570	575	264	267	275	1,253
15	876	2,127	11,525	4,836	1,879	634	475	575	264	260	265	1,074
16	1,065	1,747	10,220	4,834	1,774	636	570	650	642	264	275	1,055
17	1,581	1,639	7,330	4,000	1,615	638	765	650	642	275	290	1,055
18	1,761	1,406	5,950	4,000	1,734	642	300	703	409	264	290	855
19	1,537	1,406	5,530	4,000	1,562	644	400	1,500	409	264	265	675
20	2,190	1,372	4,577	4,122	1,562	603	400	2,050	409	263	263	650
21	8,904	1,459	3,565	3,833	1,378	564	400	1,560	318	263	265	665
22	3,132	1,459	3,477	3,833	1,525	533	300	2,120	310	258	280	675
23	2,321	1,543	3,277	3,841	1,373	495	525	925	302	255	290	650
24	1,716	1,588	3,770	4,050	1,170	450	525	730	294	255	295	625
25	1,561	1,485	4,602	4,080	1,287	404	400	730	286	255	305	625
26	1,360	1,430	17,233	3,967	1,245	428	400	730	327	258	318	575
27	1,227	1,320	28,188	3,359	1,236	422	875	670	368	260	285	525
28	1,170	1,320	16,361	3,026	1,110	403	760	887	409	260	275	2,800
29	1,039	.....	9,380	2,825	985	385	620	887	420	258	280	19,500
30	938	.....	8,834	2,708	975	367	575	875	434	285	280	13,500
31	949	.....	6,925	.....	966	.....	575	800	.....	260	.....	8,850

NOTE.—These discharges were obtained by the indirect method for shifting channels. The discharge December 10 to 14 has been estimated.

Monthly discharge of Salt River at Roosevelt, Ariz., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	8,900	753	1,470	90,400
February	2,970	863	1,430	79,400
March	35,700	1,481	7,770	478,000
April	10,500	2,700	5,080	302,000
May	2,650	966	1,690	104,000
June	960	367	667	39,700
July	875	300	514	31,600
August	2,120	417	868	53,400
September	797	264	466	27,700
October	426	255	300	18,400
November	318	257	275	16,400
December	36,600	305	4,950	304,000
The year	36,600	255	2,120	1,540,000

SALT RIVER NEAR ROOSEVELT, ARIZ.

The following measurements were made below the mouth of Cherry Creek by Mr. Bull, an engineer employed by J. G. White & Co., while investigating the practicability of developing power for transmission to the vicinity of Globe, Ariz.

Discharge measurements of Salt River, below the mouth of Cherry Creek, near Roosevelt, Ariz., in 1906.

Day.	June.		July.		August.	
	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1			−0.05	300	0.15	353
2			−.08	275	.28	408
3			−.07	280	.23	387
4			.00	310	.11	343
5			.61	620	.30	415
6			1.41	1,220	.74	720
7			.31	420	.43	490
8			.28	405	1.37	1,190
9			.26	395	1.32	1,150
10			.22	380	.42	480
11			.20	375	.59	605
12			.17	365	.59	608
13			.14	355	.38	455
14			.09	335	.24	390
15			.33	430	.41	475
16			1.09	980	.34	433
17			.42	480	.30	415
18			.23	387	.27	400
19			.08	335	.50	537
20			.04	325		
21			.00	310		
22			.03	320		
23	0.24	390	.30	415		
24	.19	370	.06	330		
25	.15	355	.02	315		
26	.12	345	.40	470		
27	.19	335	.50	537		
28	.05	320	.39	465		
29	−.00	310	.21	375		
30	−.02	305	.15	353		
31			.13	345		

SALT RIVER AT M'DOWELL, ARIZ.

This station was established April 20, 1897. It is located one-third mile above the junction of Salt and Verde rivers, 30 miles northeast of Phœnix, 15 miles northeast of Mesa, and 1¾ miles above the Arizona canal diversion dam. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 177, where are given also references to publications that contain data for previous years.

Discharge measurements of Salt River at McDowell, Ariz., by W. Rechins, in 1906.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
January 6	4.80	777	January 22	6.47	4,740
January 9	4.85	820	January 23	5.91	3,020
January 11	4.82	838	January 25	5.60	1,800
January 13	4.77	720	January 27	5.37	1,590
January 16	4.87	841	January 30	5.12	1,280
January 18	5.65	1,710	January 31	5.06	1,150
January 19	5.60	1,580	February 2	4.98	1,130
January 20	5.71	1,870	February 3	4.95	1,050
January 21	8.85	13,800	February 5	4.92	1,020

Discharge measurements of Salt River at McDowell, Ariz., by W. Richins, in 1906—Continued.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
February 7	5.00	1,150	July 6	2.75	396
February 9	5.23	1,630	July 10	2.95	502
February 12	5.60	1,960	July 12	2.95	504
February 14	6.00	2,900	July 14	2.80	417
February 16	5.68	2,260	July 17	3.22	718
February 20	5.25	1,800	July 20	2.85	498
February 22	5.26	1,830	July 24	2.70	421
February 24	5.28	2,040	July 26	2.75	510
February 27	5.13	1,680	July 28	3.55	957
March 1	5.20	1,770	July 31	2.95	528
March 3	5.40	1,920	August 2	3.10	608
March 6	5.16	1,630	August 7	3.10	623
March 8	5.09	1,690	August 9	3.20	675
March 10	5.05	1,530	August 11	3.30	762
March 13	12.05	35,300	August 14	3.30	709
March 14	11.90	34,100	August 17	3.50	753
March 15	9.10	21,600	August 20	5.50	2,249
March 16	7.70	10,600	August 22	5.45	2,254
March 17	7.10	7,470	August 24	3.70	726
March 19	6.66	5,440	August 28	3.55	560
March 20	6.50	4,750	August 30	3.68	663
March 22	6.25	3,860	September 3	3.40	568
March 24	6.45	3,700	September 5	3.20	483
March 26	7.95	8,270	September 7	3.15	400
March 28	9.25	20,380	September 10	3.00	326
March 30	7.62	8,790	September 12	3.00	346
April 3	7.04	5,320	September 14	2.95	318
April 5	6.78	4,320	September 17	3.20	431
April 7	7.05	5,020	September 19	3.15	385
April 9	7.55	7,690	September 21	3.10	377
April 11	6.90	5,710	September 25	2.95	302
April 13	6.80	5,580	September 28	2.90	285
April 17	6.30	4,560	October 1	3.20	380
April 19	6.08	4,540	October 3	3.10	371
April 21	6.05	4,440	October 5	3.00	340
April 24	6.13	4,530	October 9	2.90	303
April 26	6.03	4,240	October 12	2.85	278
April 28	5.60	3,390	October 16	2.85	287
May 1	5.17	3,010	October 19	2.80	291
May 3	5.15	2,440	October 23	2.80	278
May 5	5.10	2,060	October 26	2.85	284
May 8	5.00	2,110	October 29	2.90	297
May 10	4.90	1,830	October 31	2.95	329
May 12	4.75	1,580	November 2	2.95	344
May 15	4.75	1,680	November 7	3.00	367
May 17	4.50	1,500	November 9	3.60	372
May 18	4.45	1,490	November 13	2.95	342
May 22	4.25	1,340	November 16	2.90	326
May 24	4.15	1,280	November 20	2.85	310
May 25	4.05	1,190	November 23	2.95	339
May 29	3.75	920	November 26	3.35	611
May 31	3.70	978	November 28	3.15	479
June 2	3.65	930	November 30	3.10	451
June 5	3.60	881	December 4	11.15	27,700
June 7	3.45	765	December 6	6.70	7,090
June 9	3.40	721	December 8	6.40	2,860
June 12	3.35	742	December 11	5.60	1,830
June 15	3.30	698	December 14	5.00	1,430
June 19	3.20	602	December 18	4.65	934
June 21	3.10	563	December 21	4.40	735
June 23	3.00	475	December 26	4.20	650
June 26	2.85	404	December 28	7.80	8,550
June 29	2.75	359	December 29	10.95	24,900
July 3	2.65	342	December 31	6.75	7,020

Daily gage height, in feet, of Salt River at McDowell, Ariz., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.97	5.01	5.20	b 7.35	5.20	3.70	2.75	3.18	3.55	3.20	2.90	3.10
2	4.93	4.97	5.33	7.28	5.22	3.65	2.65	3.05	3.48	3.18	2.95	4.75
3	4.92	a 4.95	a 5.40	7.04	5.18	b 3.65	2.65	3.05	3.42	3.10	2.95	7.25
4	4.88	b 4.95	b 5.34	6.92	5.12	3.60	2.65	3.05	3.30	3.05	2.95	11.90
5	4.85	4.92	5.28	6.79	a 5.10	3.58	2.60	3.00	3.20	2.98	2.95	8.05
6	a 4.80	4.94	5.20	6.71	b 5.05	3.52	2.70	2.98	3.20	2.95	2.95	6.80
7	b 4.80	5.02	5.11	7.22	5.05	3.45	2.75	3.10	3.15	2.90	3.00	6.60
8	4.80	5.18	5.10	8.25	5.00	3.42	3.20	3.58	3.10	2.90	3.00	6.35
9	4.85	5.24	5.08	7.58	4.95	3.40	3.00	3.60	3.05	2.90	3.00	6.15
10	4.85	a 5.18	a 5.05	7.18	4.90	b 3.40	2.92	3.68	3.00	2.90	3.00	5.95
11	4.82	5.28	b 5.15	6.88	4.85	3.35	2.92	3.30	2.98	2.85	2.98	5.45
12	4.79	5.58	5.25	6.80	a 4.75	3.35	2.90	3.30	3.00	2.85	2.95	5.22
13	4.77	6.18	12.40	6.78	b 4.75	3.32	2.80	3.35	2.98	2.85	2.95	5.08
14	b 4.78	6.05	12.10	a 6.65	4.80	3.30	2.80	3.30	2.95	2.85	2.90	5.00
15	4.79	5.82	9.10	b 6.50	4.75	3.30	2.80	3.22	2.90	2.85	2.90	5.00
16	4.91	5.68	7.70	6.42	4.62	3.30	2.90	3.88	3.05	2.85	2.90	4.90
17	5.20	a 5.52	7.05	6.26	4.50	b 3.25	3.30	3.48	3.20	2.80	2.90	4.78
18	5.62	b 5.45	6.76	6.12	4.45	3.20	3.20	3.40	3.20	2.80	2.88	4.62
19	5.59	5.38	6.66	6.08	a 4.40	3.18	2.98	4.15	3.12	2.80	2.85	4.55
20	5.90	5.26	6.50	6.16	b 4.35	3.12	2.82	5.25	3.10	2.80	2.85	4.50
21	8.40	5.26	6.32	a 6.10	4.28	3.08	2.75	4.75	3.10	2.80	2.90	4.40
22	6.35	5.26	6.31	b 6.05	4.22	3.05	2.70	5.40	3.10	2.80	2.90	4.35
23	5.88	5.26	6.44	6.00	4.18	3.00	2.62	4.65	3.02	2.80	2.95	4.30
24	5.65	a 5.28	a 6.45	6.06	4.12	b 2.95	2.75	3.70	2.95	2.80	3.10	4.25
25	5.59	b 5.25	a 6.50	6.06	4.08	2.90	2.80	3.65	2.92	2.85	3.35	4.20
26	5.45	5.21	7.90	5.96	a 4.05	2.85	2.80	3.60	2.90	2.85	3.35	4.20
27	a 5.37	5.12	11.40	5.72	b 3.95	2.80	3.05	3.55	2.90	2.85	3.25	4.15
28	b 5.35	5.10	9.25	a 5.60	3.88	2.78	3.55	3.52	2.90	2.90	3.12	6.10
29	5.20	.....	8.18	b 5.40	3.75	2.78	3.25	3.95	2.90	2.90	3.10	11.45
30	5.11	.....	7.60	5.28	3.70	2.75	3.05	3.72	2.90	2.90	3.10	8.20
31	5.06	.....	a 7.40	.....	3.70	.....	2.92	3.55	.....	2.92	.....	6.70

a One reading. b Gage height interpolated.

Daily discharge, in second-feet, of Salt River at McDowell, Ariz., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	950	1,130	1,767	7,150	3,065	970	398	663	600	380	325	450
2	910	1,120	1,910	6,600	2,845	937	342	585	565	378	350	962
3	900	1,045	1,920	5,325	2,460	937	342	585	580	370	350	6,300
4	868	1,045	1,855	4,850	2,109	885	342	585	520	357	350	38,000
5	830	1,015	1,789	4,321	2,058	868	315	555	483	335	350	12,700
6	780	1,050	1,705	4,000	2,046	817	370	544	460	320	350	7,500
7	780	1,160	1,716	5,850	2,140	760	398	615	400	305	370	5,200
8	780	1,460	1,705	11,150	2,113	736	700	1,006	375	305	370	2,700
9	830	1,640	1,632	7,800	1,970	720	555	1,023	350	305	370	2,450
10	830	1,470	1,530	6,560	1,826	720	499	1,093	325	305	370	2,227
11	800	1,500	1,652	5,680	1,744	688	499	762	330	278	365	1,650
12	770	1,840	1,758	5,550	1,579	742	485	800	346	280	350	1,500
13	750	3,540	37,290	5,543	1,605	720	425	855	340	282	350	1,400
14	760	3,098	35,300	5,277	1,680	705	425	840	318	284	325	1,425
15	770	2,540	21,385	4,971	1,684	698	425	775	295	286	325	1,350
16	890	2,264	10,590	4,809	1,580	690	485	1,040	375	287	325	1,250
17	1,180	2,020	7,245	4,560	1,502	650	775	735	425	295	325	1,100
18	1,600	2,010	5,830	4,548	1,492	615	720	680	425	290	315	925
19	1,510	1,950	5,480	4,545	1,435	583	575	1,240	385	290	300	825
20	2,558	1,810	4,754	4,551	1,400	565	475	2,065	375	288	300	800
21	12,046	1,810	4,090	4,547	1,350	550	435	1,690	375	286	325	750
22	4,240	1,828	4,050	4,443	1,318	520	415	2,210	375	284	325	725
23	2,898	1,930	4,014	4,393	1,294	475	375	1,535	335	278	350	700
24	2,000	2,037	3,700	4,375	1,250	452	445	725	305	276	430	675
25	1,770	2,020	3,275	4,320	1,216	430	520	670	293	284	610	650
26	1,610	1,960	7,990	4,110	1,170	408	545	630	285	284	610	650
27	1,587	1,660	28,200	3,630	1,090	385	660	575	285	284	530	640
28	1,530	1,570	16,566	3,388	1,020	376	962	535	285	296	440	2,490
29	1,380	.....	11,330	3,180	920	376	738	905	285	296	430	31,900
30	1,260	.....	8,772	3,070	940	362	592	705	285	296	430	12,600
31	1,148	.....	7,472	.....	978	.....	499	560	.....	310	.....	6,900

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Salt River at McDowell, Ariz., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	12,000	750	1,660	102,000
February	3,540	1,020	1,770	98,300
March	37,300	1,530	8,010	493,000
April	11,200	3,070	5,100	303,000
May	3,060	920	1,640	101,000
June	970	362	645	38,400
July	962	315	508	31,200
August	2,210	535	896	55,100
September	600	285	379	22,600
October	380	276	303	18,600
November	610	300	377	22,400
December	38,000	450	4,820	296,000
The year	38,000	276	2,180	1,580,000

VERDE RIVER AT M'DOWELL, ARIZ.

This station was established April 20, 1897. It is located 30 miles northeast of Phœnix, 15 miles northeast of Mesa, 2⅛ miles above the Arizona Canal diversion dam, and three-fourths mile above the mouth, of the river. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 181, where are given also references to publications that contain data for previous years.

Discharge measurements of Verde River at McDowell, Ariz., by W. Richins, in 1906.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
January 5	3.60	482	March 24	5.20	1,290
January 9	3.60	447	March 26	12.25	20,700
January 11	3.56	483	March 27 [a]	15.20	37,500
January 13	3.56	472	March 28	10.10	13,700
January 16	3.56	490	March 30	6.35	3,790
January 18	3.95	715	April 3	4.10	1,460
January 19	4.30	995	April 5	3.75	1,160
January 20	4.45	1,050	April 7	3.85	1,180
January 21	6.90	3,750	April 9	5.00	2,690
January 22	5.80	2,780	April 11	4.60	1,800
January 23	5.20	1,580	April 13	3.90	1,150
January 25	4.50	979	April 17	3.03	762
January 27	4.20	750	April 19	2.83	637
January 30	3.92	621	April 21	2.70	549
January 31	3.86	577	April 24	2.43	466
February 2	3.76	553	April 26	2.40	403
February 3	3.75	499	April 28	2.50	372
February 5	3.76	522	May 1	2.48	336
February 7	3.92	690	May 3	2.47	331
February 9	4.45	1,090	May 5	2.47	310
February 12	5.00	1,440	May 8	2.50	280
February 14	5.50	1,790	May 10	2.40	261
February 16	5.53	1,880	May 12	2.40	256
February 20	5.25	1,600	May 15	2.40	212
February 22	5.25	1,670	May 17	2.35	217
February 24	4.90	1,390	May 18	2.35	212
February 27	4.45	943	May 22	2.35	197
March 1	4.45	927	May 24	2.30	188
March 3	4.70	1,130	May 25	2.30	191
March 6	4.17	743	May 29	2.30	212
March 8	4.05	610	May 31	2.30	193
March 11	3.95	539	June 2	2.30	196
March 13	8.70	7,710	June 5	2.30	194
March 14 [a]	14.65	31,600	June 7	2.25	176
March 15	10.70	15,520	June 9	2.25	170
March 16	8.95	6,010	June 12	2.20	149
March 17	7.90	3,520	June 15	2.20	163
March 19	7.00	3,380	June 19	2.10	124
March 20	6.40	2,240	June 21	2.10	134
March 22	5.60	1,440	June 23	2.10	122

[a] Float measurement.

Discharge measurements of Verde River at McDowell, Ariz., by W. Richins, in 1906—Cont'd.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*		*Feet.*	*Sec.-ft.*
June 26	2.05	118	September 28	2.35	131
June 29	2.05	121	October 1	2.40	146
July 3	2.05	105	October 3	2.40	182
July 6	2.25	151	October 5	2.40	161
July 10	2.25	181	October 9	2.40	150
July 12	2.30	186	October 12	2.45	174
July 14	2.30	185	October 16	2.45	191
July 17	2.40	254	October 19	2.45	174
July 20	2.40	223	October 23	2.45	180
July 24	2.25	188	October 26	2.50	215
July 26	2.52	268	October 29	2.55	226
July 28	3.05	604	October 31	2.60	246
July 31	2.60	305	November 2	2.60	266
August 2	2.65	353	November 7	2.65	284
August 7	3.00	511	November 9	2.65	278
August 9	2.85	414	November 13	2.65	274
August 11	2.95	438	November 16	2.65	273
August 14	2.95	409	November 20	2.65	288
August 17	3.00	480	November 23	2.70	298
August 20	5.00	2,400	November 26	3.00	518
August 22	4.90	2,250	November 28	2.95	405
August 24	3.50	855	November 30	2.85	373
August 28	2.90	384	December 4	12.40	19,800
August 30	3.08	554	December 6	6.05	3,750
September 3	2.80	304	December 8	4.00	1,600
September 5	2.70	320	December 11	3.50	976
September 7	2.65	258	December 14	4.35	1,340
September 10	2.55	218	December 18	3.00	702
September 12	2.55	213	December 21	2.65	540
September 14	2.50	200	December 26	2.45	420
September 17	2.45	169	December 28	2.60	571
September 19	2.45	177	December 29	11.00	13,000
September 21	2.50	177	December 31	6.50	4,030
September 25	2.40	155			

Daily gage height, in feet, of Verde River at McDowell, Ariz., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.61	3.80	4.48	b 4.90	2.53	2.30	2.05	2.98	2.90	2.40	2.60	3.23
2	3.59	3.76	4.68	4.40	2.53	2.30	2.05	2.60	2.85	2.38	2.60	4.92
3	3.58	a 3.75	a 4.70	4.05	2.52	2.30	2.05	2.90	2.80	2.40	2.60	8.60
4	3.59	b 3.75	b 4.50	3.92	2.52	2.30	2.05	3.70	2.75	2.40	2.60	11.50
5	3.60	3.75	4.30	3.75	a 2.47	2.30	2.05	3.40	2.70	2.40	2.60	8.90
6	a 3.55	3.74	4.14	3.70	b 2.50	2.30	2.38	3.08	2.70	2.35	2.60	5.75
7	b 3.55	3.96	4.10	3.92	2.52	2.25	2.25	2.98	2.65	2.40	2.65	4.80
8	3.55	4.19	4.05	4.20	2.50	2.25	2.25	2.90	2.65	2.40	2.65	3.95
9	3.60	4.48	3.98	5.10	2.45	2.25	2.20	2.85	2.60	2.40	2.65	3.90
10	3.60	a 4.45	a 3.95	5.20	2.40	2.20	2.25	2.75	2.58	2.40	2.65	3.55
11	3.57	4.68	b 4.00	4.50	2.40	2.20	2.28	2.95	2.55	2.42	2.65	3.48
12	3.56	4.98	4.10	4.08	a 2.40	2.20	2.30	3.00	2.52	2.45	2.65	3.40
13	3.56	5.15	11.30	3.65	b 2.40	2.20	2.30	3.00	2.50	2.45	2.65	3.35
14	b 3.55	5.48	14.60	a 3.50	2.40	2.20	2.30	2.92	2.50	2.45	2.65	4.35
15	3.55	5.75	10.35	b 3.30	2.40	2.20	2.30	2.78	2.50	2.45	2.65	3.95
16	3.58	5.43	8.70	3.14	2.40	2.20	2.25	3.48	2.45	2.45	2.65	3.50
17	3.66	a 5.40	7.70	2.99	2.35	2.15	2.40	3.05	2.45	2.45	2.65	3.15
18	4.01	b 5.35	7.90	2.92	2.35	2.12	2.45	3.00	2.45	2.45	2.65	2.98
19	4.30	5.30	7.00	2.82	a 2.35	2.10	2.42	4.02	2.45	2.45	2.65	2.80
20	4.42	5.18	6.40	2.75	b 2.35	2.10	2.38	5.05	2.48	2.45	2.65	2.72
21	6.85	5.18	5.90	a 2.70	2.35	2.10	2.35	4.80	2.48	2.45	2.65	2.65
22	5.75	5.12	5.50	b 2.60	2.32	2.10	2.32	4.65	2.45	2.45	2.65	2.60
23	5.10	5.00	5.25	2.53	2.30	2.10	2.28	3.82	2.40	2.45	2.70	2.55
24	4.72	a 4.90	5.20	2.46	2.30	2.10	2.22	3.42	2.40	2.50	2.85	2.50
25	4.45	b 4.75	a 5.40	2.45	2.30	2.05	2.22	3.25	2.40	2.50	3.00	2.45
26	4.28	4.63	12.40	2.42	a 2.30	2.05	2.90	3.10	2.35	2.50	3.00	2.45
27	a 4.20	4.42	14.40	2.47	b 2.30	2.05	2.95	2.98	2.38	2.50	2.95	2.42
28	b 4.10	4.35	9.85	a 2.50	2.30	2.05	3.05	2.88	2.35	2.52	2.92	4.02
29	3.98	.....	7.90	b 2.50	2.30	2.05	2.88	2.85	2.35	2.55	2.90	10.65
30	3.90	.....	6.15	2.49	2.30	2.05	2.72	3.05	2.35	2.55	2.85	8.05
31	a 3.86	.....	a 5.30	.....	2.30	.....	2.58	3.02	.....	2.60	.....	6.15

a One reading. b Gage height interpolated.

Daily discharge, in second-feet, of Verde River at McDowell, Ariz., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	489	560	984	2,280	380	195	109	495	385	145	266	855
2	482	544	1,144	1,770	380	195	107	355	340	160	266	2,600
3	478	500	1,160	1,410	370	195	105	470	310	180	266	8,200
4	482	513	1,000	1,300	365	195	105	1,150	312	170	266	15,450
5	485	518	840	1,158	310	195	105	850	320	160	266	8,800
6	468	570	718	1,100	300	195	195	590	320	147	266	3,400
7	468	700	665	1,235	315	178	158	495	260	155	280	2,390
8	468	900	610	1,700	280	174	166	420	260	153	280	1,450
9	477	1,105	560	2,770	270	170	173	370	235	150	280	1,425
10	485	1,050	539	2,680	261	153	181	345	220	150	280	1,050
11	486	1,195	574	1,700	258	151	183	440	215	160	280	950
12	480	1,400	643	1,315	256	149	186	480	213	175	280	900
13	472	1,520	12,000	975	240	154	186	480	200	179	280	875
14	480	1,770	31,300	910	225	158	186	390	200	183	280	1,340
15	485	2,130	14,450	820	212	163	186	375	200	186	280	1,150
16	495	1,770	5,090	785	215	163	190	840	170	190	280	950
17	562	1,780	3,340	715	217	143	254	520	170	185	280	790
18	770	1,700	3,925	675	212	130	260	480	173	180	280	700
19	995	1,650	3,377	637	209	124	237	1,370	177	175	280	625
20	1,030	1,530	2,240	570	205	124	215	2,465	180	175	280	590
21	3,679	1,582	1,712	550	201	124	213	2,150	178	175	280	550
22	2,710	1,570	1,395	510	195	124	205	2,000	170	175	280	530
23	1,510	1,480	1,300	495	190	124	198	1,170	150	180	295	500
24	1,176	1,392	1,287	470	188	124	185	855	150	200	355	475
25	960	1,260	1,350	450	191	120	185	670	150	207	520	450
26	824	1,140	21,375	415	195	120	420	560	130	215	520	450
27	760	936	30,450	385	200	117	555	465	145	210	450	430
28	690	880	12,950	372	205	115	604	385	130	205	408	1,200
29	632	.....	7,100	360	212	113	495	340	130	225	380	12,300
30	600	.....	2,536	350	203	111	395	555	130	225	355	7,100
31	584	.....	2,690	.....	193	.....	305	495	.....	245	.....	3,350

NOTE.—These discharges were obtained by the indirect method for shifting channels.

Monthly discharge of Verde River at McDowell, Ariz., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	3,680	468	812	49,900
February	2,130	500	1,200	66,600
March	31,300	539	5,460	336,000
April	2,770	350	1,030	61,300
May	380	188	247	15,200
June	195	111	133	8,930
July	604	105	234	14,400
August	2,460	340	743	45,700
September	385	130	211	12,600
October	245	145	181	11,100
November	520	266	312	18,600
December	15,400	430	2,640	162,000
The year	31,300	105	1,100	802,000

SANTA CRUZ RIVER AND DITCHES AT TUCSON, ARIZ.

This station was established October 15, 1905, by G. E. P. Smith. It is located at Congress Street Bridge, Tucson, Ariz. The conditions at this station and the bench marks are described in Water-Supply Paper No. 175, page 185.

Manning and Farmers ditches divert practically the entire flow during the low period of Santa Cruz River. These ditches are taken

out just above the gaging station, and their flow is determined by current-meter measurements, supplemented by daily records kept by the ditch management, as to the amount of water contained in each. This water is used to irrigate lands on the north and south sides of Santa Cruz River in and about the vicinity of Tucson.

Discharge measurements of Santa Cruz River at Tucson, Ariz., by G. E. P. Smith, in 1905–6.

Date.	Gage height.	Discharge.	Date.	Gage height.	Discharge.
1905.	*Feet.*	*Sec.-ft.*	1906.	*Feet.*	*Sec.-ft.*
November 27	1.58	251	February 13	2.65	1,170
November 28	3.60	2,520	February 13	2.55	1,020
December 27	.72	40	February 14	2.00	583
			February 15	1.62	380
1906.			March 28	.25	.3
January 17	.80	9.2	July 25 [a]	.80	25
February 5	.94	15	August 20	.63	25
February 12	3.25	1,750	December 3	1.50	275

[a] Float measurement.

Discharge measurements of ditches near Tucson, Ariz., by G. E. P. Smith, in 1906.

Date.	Ditch.	Discharge.	Date.	Ditch.	Discharge.
		Sec.-ft.			*Sec.-ft.*
March 28	Farmers	[a] 2.8	July 29	Manning	4.2
March 28	Manning	10.4	August 4 [b]	do	4.5
April 29	do	10.9	August 4 [c]	do	4.6
May 27	do	13.0	August 5	Farmers	4.6
June 10	Farmers	5.3	August 26	do	4.2
July 29	do	4.2	August 26	Manning	5.7

[a] Three-fourths of the discharge was used above point of measurement; total discharge of both ditches, about 20 second-feet.
[b] 2 p. m.
[c] 4 p. m.

Daily gage height, in feet, of Santa Cruz River at Tucson, Ariz., for 1906.

Day.	Jan.	Feb.	March.	Dec.	Day.	Jan.	Feb.	March.	Dec.
1	0.80		0.80		17	0.80	1.30	1.20	
2	.80		.80	0.70	18	.80	1.00		
3	.80		.80	1,80	19	.80	1.00		
4	.80			.70	20	.80	1.00		
5	.80	0.94			21	.80	1.00		
6	.80	.94			22	.80	1.00		
7	.80	.94			23	.80	1.00		
8	.80	.94			24	.80	1.00		
9	.80	.94			25	.80	.80		
10	.80	.94			26	.80	.80		
11	.80	.90			27	.80	.80		0.50
12	.80	3.10			28	.80	.80		.75
13	.80	2.75			29	.80			.80
14	.80	2.15			30	.80			.85
15	.80	1.65	1.20		31	.80			.70
16	.80	1.35	1.20						

Daily discharge, in second-feet, of Santa Cruz River at Tucson, Ariz., for 1905–6.

Day.	1905.		1906.				Day.	1905.		1906.			
	Nov.	Dec.	Jan.	Feb.	Mar.	Dec.		Nov.	Dec.	Jan.	Feb.	Mar.	Dec.
1		40	10	.....	10	.....	17	10	40	10	170	340	10
2		40	10	.....	10	35	18	10	40	10	40	.....	10
3		40	10	.....	10	820	19	10	40	10	40	.....	10
4		40	10	.....	.....	35	20	10	40	10	40	.....	10
5		40	10	25	.....	10	21	10	40	10	40	.....	10
6		40	10	25	.....	10	22	350	40	10	40	.....	10
7		40	10	25	.....	10	23	125	35	10	40	.....	10
8	350	40	10	25	.....	10	24	580	35	10	40	.....	10
9	150	40	10	25	.....	10	25	170	30	10	10	.....	10
10		40	10	25	.....	10	26	75	30	10	10	.....	10
11		40	10	20	.....	10	27	210	25	10	10	.....	10
12		40	10	1,575	.....	10	28	3,200	20	10	10	.....	50
13		40	10	1,225	.....	10	29	925	20	10	.....	.....	75
14		40	10	710	.....	10	30	250	15	10	.....	.....	50
15		40	10	350	340	10	31	.....	15	10	.....	.....	35
16		40	10	190	340	10							

NOTE.—These discharges were obtained by the indirect method for shifting channels. The river was dry on days when discharge is not given.

Monthly discharge of Santa Cruz River and ditches at Tucson, Ariz., for 1905–6.

Month.	Discharge in second-feet.			Acre-feet.			
	Maximum.	Minimum.	Mean.	River.	Farmers ditch.	Manning ditch.	Total.
1905.							
November	3,200	0	215	12,800	134	308	13,200
December	40	15	35.6	2,190	0	0	2,190
1906.							
January	10	10	10.0	615	290	0	905
February	1,580	0	168	9,330	221	159	9,710
March	340	0	33.9	2,080	420	496	3,000
April	.....	.....	.0	0	371	661	1,030
May	.....	.....	.0	0	229	694	923
June	.....	.....	.0	0	318	508	826
July	.....	.....	.0	0	231	324	555
August	.....	.....	.0	0	179	386	565
September	.....	.....	.0	0	224	390	614
October	.....	.....	.0	0	263	423	686
November	.....	.....	.0	0	182	513	695
December	820	0	42.9	2,640	88	438	3,170
The year	.....	.....	.....	14,700	3,020	4,600	22,300

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O

Water-Supply Paper No. 212

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY
GEORGE OTIS SMITH, DIRECTOR

SURFACE WATER SUPPLY
OF THE
GREAT BASIN DRAINAGE
1906

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SURFACE WATER SUPPLY OF THE GREAT BASIN DRAINAGE 1906.[a]

E. C. La Rue, Thomas Grieve, Jr., and Henry Thurtell,
District hydrographers.

INTRODUCTION.

SCOPE OF WORK.

The water supply of the United States is of more importance to the life and pursuits of the people than any other natural resource. In the arid States the limit of agricultural development is determined by the amount of water available for irrigation, while in all parts of the country the increase in the population of cities and towns makes necessary additional water supplies for domestic and industrial uses, in procuring which both the quantity and the quality of the water that may be obtained must be considered. The location of manufacturing plants may depend largely on the water-power facilities and on the character of the water. The notable advances made in the electric transmission of power have led to the utilization of water powers for the operation of manufacturing establishments, railroads, and municipal lighting plants, many of which are at some distance from the places at which the power is developed.

The intelligent establishment and maintenance of enterprises or industries that depend on the use of water demands a thorough knowledge of the flow of the streams and an understanding of the conditions affecting that flow. This knowledge should be based on data showing both the total flow and the distribution of the flow throughout the year, in order that normal fluctuations may be provided for. As the flow of a stream is variable from year to year, estimates of future flow can be made only from a study of observations covering several years. The rapid increase in the development of the water

[a] This report contains information similar to that published for previous years under the title "Report of Progress of Stream Measurements."

resources of the United States has caused a great demand by engineers for information in regard to the flow of streams, as it is now generally realized that the failure of many large power, irrigation, and other projects has been due to the fact that the plans were made without sufficient trustworthy information in respect to the water supply.

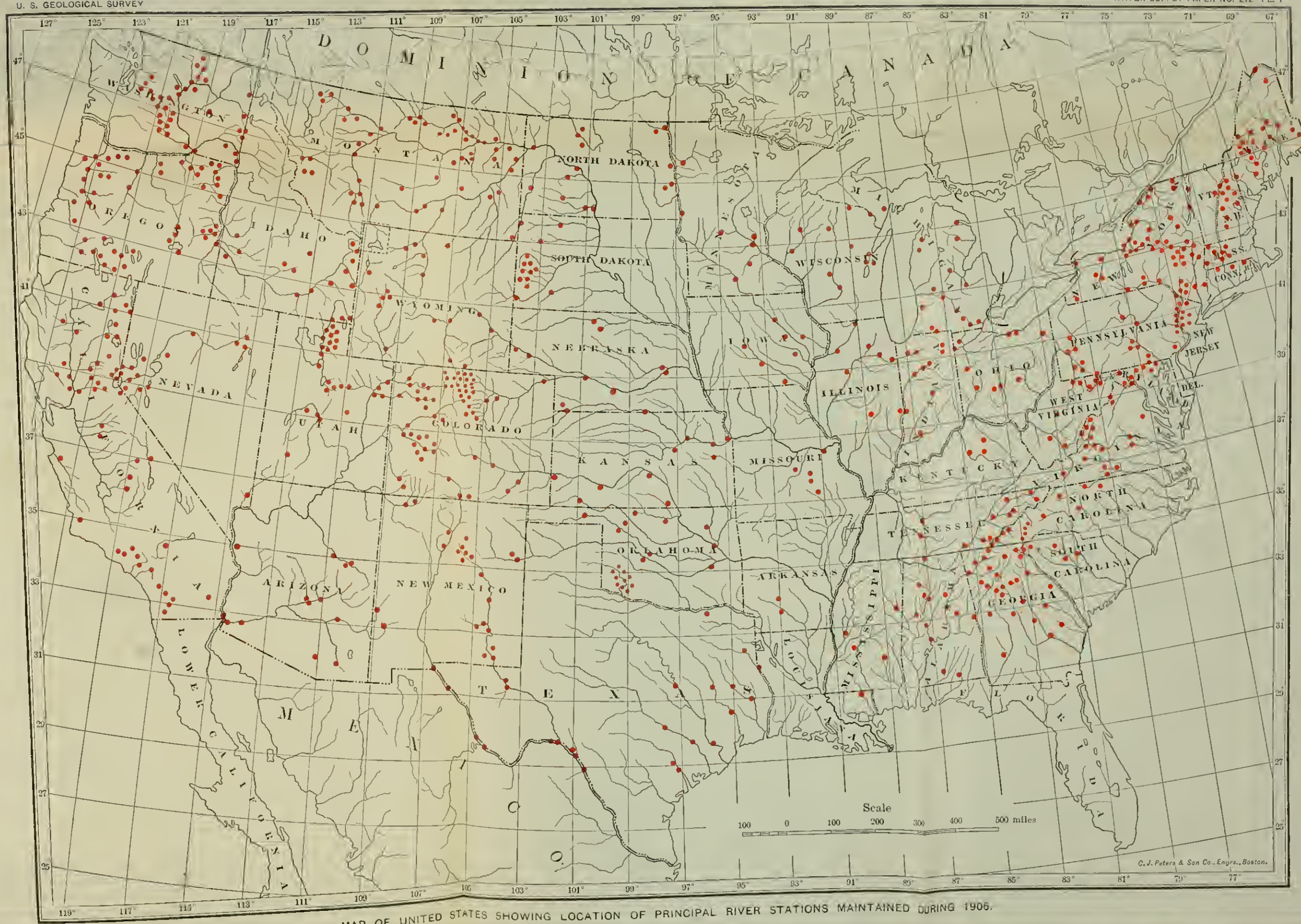
Owing to the broad scope of these hydrographic investigations and the length of time they should cover in order that the records may be of greatest value, it is in general impossible for private individuals to collect the necessary data, and as many of the streams traverse more than one State this work does not properly fall within the province of the State authorities. The United States Geological Survey has, therefore, by means of specific appropriations by Congress, for several years systematically made records of stream flow, with the view of ultimately determining all the important features governing the flow of the principal streams of the country. In carrying out this plan stations are established on the streams and maintained for a period long enough to show their regimen or general behavior. When a record that is sufficient for this purpose has been obtained for any stream, the work on that stream is discontinued. The order in which the streams are measured is determined by the degree of their importance.

During 1906 the regimen of flow was studied at about 700 stations distributed along the various rivers throughout the United States, as shown on Pl. I. In addition to these records data in regard to precipitation, evaporation, water power, and river profiles were obtained in many sections of the country.

These data have been assembled by drainage areas and are published in a series of fourteen Water-Supply and Irrigation Papers, Nos. 201 to 214, inclusive, each of which pertains to the surface water resources of a group of adjacent areas. In these papers are embodied not only the data collected in the field, but also the results of computations based on these data and other information that has a direct bearing on the subject, such as descriptions of basins and the streams draining them, utility of the water resources, etc. The list follows.

Water-Supply and Irrigation Papers on surface water supply, 1906.

201. Surface water supply of New England, 1906. (Atlantic coast of New England drainage.)
202. Surface water supply of the Hudson, Passaic, Raritan, and Delaware river drainages, 1906.
203. Surface water supply of the Middle Atlantic States, 1906. (Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages.)
204. Surface water supply of the Southern Atlantic and Eastern Gulf States, 1906. (Santee, Savannah, Ogeechee, and Altamaha rivers, and eastern Gulf of Mexico drainages.)
205. Surface water supply of the Ohio and lower eastern Mississippi river drainages, 1906.



MAP OF UNITED STATES SHOWING LOCATION OF PRINCIPAL RIVER STATIONS MAINTAINED DURING 1906.

206 Surface water supply of the Great Lakes and St. Lawrence River drainages, 1906.
207. Surface water supply of the upper Mississippi River and Hudson Bay drainages, 1906.
208. Surface water supply of the Missouri River drainage, 1906.
209. Surface water supply of the lower western Mississippi River drainage, 1906.
210. Surface water supply of the western Gulf of Mexico and Rio Grande drainages, 1906.
211. Surface water supply of the Colorado River drainage above Yuma, 1906.
212. Surface water supply of the Great Basin drainage, 1906.
213. Surface water supply of California, 1906. (The Great Basin and Pacific Ocean drainages in California and Colorado River drainage below Yuma.)
214. Surface water supply of the North Pacific Coast, 1906.

The records at most of the stations discussed in these reports extend over a series of years. An index of the reports containing such records up to and including 1903 has been published in Water-Supply Paper No. 119. The following table gives, by years and primary drainage basins, the numbers of the papers on surface water supply published from 1901 to 1906:

Numbers of Water-Supply Papers containing results of stream measurements, 1901–1906.[a]

	1901.	1902.	1903.	1904.	1905.	1906.
	No.	*No.*	*No.*	*No.*	*No.*	*No.*
Atlantic coast of New England drainage	65 75	82	97	124	165	201
Hudson, Passaic, Raritan, and Delaware river drainages	65 75	82	97	125	166	202
Susquehanna, Gunpowder, Patapsco, Potomac, James, Roanoke, and Yadkin river drainages	65 75	82 83	97 98	126	167	203
Santee, Savannah, Ogeechee, and Altamaha rivers and eastern Gulf of Mexico drainages	65 75	83	98	127	168	204
Ohio and lower eastern Mississippi river drainages	65 75	83	98	128	169	205
Great Lakes and St. Lawrence River drainages	65	83	97	129	170	206
Hudson Bay and upper eastern and western Mississippi River drainages	65 66 75	83 84 85	98 99 100	128 130	171	207
Missouri River drainage	66 75	84	99	130 131	172	208
Meramec, Arkansas, Red, and lower western Mississippi river drainages	66 75	84	99	131	173	209
Western Gulf of Mexico and Rio Grande drainages	66 75	84	99	132	174	210
Colorado River drainage, above Yuma	66 75	85	100	133	175	211
The Great Basin drainage	66 75	85	100	133	176	212
The Great Basin and Pacific Ocean drainages in California, and Colorado River drainage, below Yuma	66 75	85	100	134	177	213
North Pacific Coast drainage	66 75	85	100	135	178	214

[a] Reports containing data for years prior to 1901 are noted in the series list at the end of this paper.

DEFINITIONS.

The volume of water flowing in a stream—the "run-off" or "discharge"—is expressed in various terms, each of which has become associated with a certain class of work. These terms may be divided into two groups: (1) Those which represent a rate of flow, as second-feet, gallons per minute, miner's inches, and run-off in second-feet per square mile, and (2) those which represent the actual quantity of water,

as run-off in depth in inches and acre-feet. They may be defined as follows:

"Second-foot" is an abbreviation for cubic foot per second and is the quantity of water flowing in a stream 1 foot wide, 1 foot deep, at a rate of 1 foot per second. It is generally used as a fundamental unit from which others are computed.

"Gallons per minute" is generally used in connection with pumping and city water supply.

The "miner's inch" is the quantity of water that passes through an orifice 1 inch square under a head which varies locally. It has been commonly used by miners and irrigators throughout the West and is defined by statute in each State in which it is used.

"Second-feet per square mile" is the average number of cubic feet of water flowing per second from each square mile of area drained, on the assumption that the run-off is distributed uniformly both as regards time and area.

"Run-off in inches" is the depth to which the drainage area would be covered if all the water flowing from it in a given period were conserved and uniformly distributed on the surface. It is used for comparing run-off with rainfall, which is usually expressed in depth in inches.

"Acre-foot" is equivalent to 43,560 cubic feet, and is the quantity required to cover an acre to the depth of 1 foot. It is commonly used in connection with storage for irrigation work. There is a convenient relation between the second-foot and the acre-foot: One second-foot flowing for twenty-four hours will deliver 86,400 cubic feet, or approximately 2 acre-feet.

EXPLANATION AND USE OF TABLES.

For each regular gaging station are given, as far as available, the following data:

1. Description of station.
2. List of discharge measurements.
3. Gage-height table.
4. Rating table.
5. Table of monthly and yearly discharges and run-off.
6. Tables showing discharge and horsepower and the number of days during the year when the same are available.

The descriptions of stations give such general information about the locality and equipment as would enable the reader to find and use the station, and they also give, as far as possible, a complete history of all the changes that have occurred since the establishment of the station that would be factors in using the data collected.

The discharge-measurement table gives the results of the discharge measurements made during the year, including the date, name of the

hydrographer, width and area of cross section, gage height, and discharge in second-feet.

The table of daily gage heights gives the daily fluctuations of the surface of the river as found from the mean of the gage readings taken each day. The gage height given in the table represents the elevation of the surface of the water above the zero of the gage. At most stations the gage is read in the morning and in the evening.

The discharge measurements and gage heights are the base data from which the other tables are computed. In cases of extensive development it is expected that engineers will use these original data in making their calculations, as the computations made by the Survey are based on the data available at the time they are made and should be reviewed and, if necessary, revised when additional data are available.

The rating table gives the discharge in second-feet corresponding to various stages of the river as given by the gage heights. It is published to enable engineers to determine the daily discharge in case this information is desired.

In the table of monthly discharge the column headed "Maximum" gives the mean flow for the day when the mean gage height was highest, and it is the flow as given in the rating table for that mean gage height. As the gage height is the mean for the day, there might have been short periods when the water was higher and the corresponding discharge larger than given in this column. Likewise in the column of "Minimum" the quantity given is the mean flow for the day when the mean gage height was lowest. The column headed "Mean" is the average flow for each second during the month. Upon this the computations for the remaining columns, which are defined on page 4, are based.

The values in the table of monthly discharge are intended to give only a general idea of the conditions of flow at the station, and it is not expected that they will be used for other than preliminary estimates.

In most work where data in regard to flow are used the regimen of flow is of primary importance. Therefore for the principal stations tables have been prepared showing the horsepower that can be developed at various rates of flow, and the length of time that these rates of flow and the corresponding horsepower are available. These tables have been prepared on a basis of 80 per cent efficiency on the turbines, and the horsepower per foot of fall is given in order that the reader can determine the horsepower for any fall.

In the computations sufficient significant figures have been used so that the percentage of error in the tables will not in general exceed 1 per cent. Therefore, most of the values in the tables are given to only three significant figures. In making the various computations Thatcher's slide rule, Crelle's tables, and computation machines have been generally used.

In order to give engineers an idea of the relative value of the various data notes in regard to accuracy are given as far as possible. This accuracy depends on the general local conditions at the gaging stations and the amount of data collected. Every effort possible is made to so locate the stations that the data collected will give a high degree of accuracy. This is not always possible, but it is considered better to publish rough values with explanatory notes rather than no data.

In the accuracy notes the following terms have been used, indicating the probable accuracy, in per cent, of the mean monthly flow. As these values are mean values, the error in the value for the flow of any individual day may be much larger.

Excellent indicates that the mean monthly flow is probably accurate to within 5 per cent; good, to within 10 per cent; fair, to within 15 per cent; approximate, to within 25 per cent.

CONVENIENT EQUIVALENTS.

Following is a table of convenient equivalents for use in hydraulic computations:

1 second-foot equals 40 California miner's inches (law of March 23, 1901).
1 second-foot equals 38.4 Colorado miner's inches.
1 second-foot equals 40 Arizona miner's inches.
1 second-foot equals 7.48 United States gallons per second; equals 448.8 gallons per minute; equals 646,272 gallons for one day.
1 second-foot equals 6.23 British imperial gallons per second.
1 second-foot for one year covers 1 square mile 1.131 feet or 13.572 inches deep.
1 second-foot for one year equals 31,536,000 cubic feet.
1 second-foot equals about 1 acre-inch per hour.
1 second-foot for one day covers 1 square mile 0.03719 inch deep.
1 second-foot for one 28-day month covers 1 square mile 1.041 inches deep.
1 second foot for one 29-day month covers 1 square mile 1.079 inches deep.
1 second-foot for one 30-day month covers 1 square mile 1.116 inches deep.
1 second-foot for one 31-day month covers 1 square mile 1.153 inches deep.
1 second-foot for one day equals 1.983 acre-feet.
1 second-foot for one 28-day month equals 55.54 acre-feet.
1 second-foot for one 29-day month equals 57.52 acre-feet.
1 second-foot for one 30-day month equals 59.50 acre-feet.
1 second-foot for one 31-day month equals 61.49 acre-feet.
100 California miner's inches equal 18.7 United States gallons per second.
100 California miner's inches equal 96.0 Colorado miner's inches.
100 California miner's inches for one day equal 4.96 acre-feet.
100 Colorado miner's inches equal 2.60 second-feet.
100 Colorado miner's inches equal 19.5 United States gallons per second.
100 Colorado miner's inches equal 104 California miner's inches.
100 Colorado miner's inches for one day equal 5.17 acre-feet.
100 United States gallons per minute equal 0.223 second-feet.
100 United States gallons per minute for one day equal 0.442 acre-foot.
1,000,000 United States gallons per day equal 1.55 second-feet.
1,000,000 United States gallons equal 3.07 acre-feet.
1,000,000 cubic feet equal 22.95 acre-feet.

1 acre-foot equals 325,850 gallons.
1 inch deep on 1 square mile equals 2,323,200 cubic feet.
1 inch deep on 1 square mile equals 0.0737 second-foot per year.
1 foot equals 0.3048 meter.
1 mile equals 1.60935 kilometers.
1 mile equals 5,280 feet.
1 acre equals 0.4047 hectare.
1 acre equals 43,560 square feet.
1 acre equals 209 feet square, nearly.
1 square mile equals 2.59 square kilometers.
1 cubic foot equals 0.0283 cubic meter.
1 cubic foot equals 7.48 gallons.
1 cubic foot of water weighs 62.5 pounds.
1 cubic meter per minute equals 0.5886 second-foot.
1 horsepower equals 550 foot-pounds per second.
1 horsepower equals 76.0 kilogram-meters per second.
1 horsepower equals 746 watts.
1 horsepower equals 1 second-foot falling 8.80 feet.
$1\frac{1}{3}$ horsepower equal about 1 kilowatt.

To calculate water power quickly: $\frac{\text{Sec.-ft.} \times \text{fall in feet}}{11}$ = net horsepower on water wheel, realizing 80 per cent of theoretical power.

FIELD METHODS OF MEASURING STREAM FLOW.

The methods used in collecting these data and in preparing them for publication are given in detail in Water-Supply Papers No. 94 (Hydrographic Manual, U. S. Geol. Survey) and No. 95 (Accuracy of Stream Measurements). In order that those who use this report may readily become acquainted with the general methods employed, the following brief descriptions are given:

Streams may be divided, with respect to their physical conditions, into three classes: (1) Those with permanent beds; (2) those with beds which change only during extreme low or high water; and (3) those with constantly shifting beds. In determining the daily flow special methods are necessary for each class. The data on which the determinations are based and the methods of collecting them are, however, in general the same.

There are three distinct methods of determining the flow of open-channel streams: (1) By measurements of slope and cross section and the use of Chezy's and Kutter's formulas; (2) by means of a weir, (3) by measurements of the velocity of the current and of the area of the cross section. The method chosen for any case depends on the local physical conditions, the degree of accuracy desired, the funds available, and the length of time that the record is to be continued.

Slope method.—Much information has been collected relative to the coefficients to be used in the Chezy formula, $v = c\sqrt{Rs}$. This has been utilized by Kutter, both in developing his formula for c and in determining the values of the coefficient n which appears therein. The

results obtained by the slope method are in general only roughly approximate, owing to the difficulty in obtaining accurate data and the uncertainty of the value for n to be used in Kutter's formula. The most common use of this method is in estimating the flood discharge of a stream when the only data available are the cross section, the slope as shown by marks along the bank, and a knowledge of the general conditions.

Weir method.—When funds are available and the conditions are such that sharp-crested weirs can be erected, these offer the best facilities for determining flow. If dams are suitably situated and constructed, they may be utilized for obtaining reliable measurements of flow. The conditions necessary to insure good results may be divided into two classes: (1) Those relating to the physical characteristics of the dam itself, and (2) those relating to the diversion and use of water around and through the dam.

The physical requirements are as follows: (*a*) Sufficient height of dam, so that backwater will not interfere with free fall over it; (*b*) absence of leaks of appreciable magnitude; (*c*) topography or abutments which confine the flow over the dam at high stages; (*d*) level crests which are kept free from obstructions caused by floating logs or ice; (*e*) crests of a type for which the coefficients to be used in $Q = c\ b\ h^{\frac{3}{2}}$, or some similar standard weir formula, are known (see Water-Supply Papers Nos. 180 and 200[a]); (*f*) either no flashboards or exceptional care in reducing leakage through them and in recording their condition.

Preferably there should be no diversion of water through or around the dam. Generally, however, the dam is built for purposes of power or navigation, and part or all of the water flowing past it is diverted for such uses. This water is measured and added to that passing over the dam. To insure accuracy in such determinations of flow, the amount of water diverted should be reasonably constant. Furthermore, it should be so diverted that it can be measured, either by a weir, a current meter, or a simple system of water wheels which are of standard make, or which have been rated as meters under working conditions and so installed that the gate openings, the heads under which they work, and their angular velocities may be accurately observed.

The combination of physical conditions and uses of the water should be such that the determinations of flow will not involve, for a critical stage of considerable duration, the use of a head on a broad-crested dam of less than 6 inches. Moreover, when all other conditions are good, the cooperation of the owners or operators of the plant is still essential if reliable results are to be obtained.

[a] Water-Supply Paper No. 200 replaces No. 150, the edition of which has been exhausted.

A gaging station at a weir or dam has the general advantage of continuity of record through the period of ice and floods and the disadvantages of uncertainty of coefficient to be used in the weir formula and of complications in the diversion and use of the water.

Velocity method.—The determination of the quantity of water flowing past a certain section of a stream at a given time is termed a discharge measurement. This quantity is the product of two factors—the mean velocity and the area of the cross section. The mean velocity is a function of surface slope, wetted perimeter, roughness of bed, and the channel conditions at, above, and below the gaging section. The area depends on the contour of the bed and the fluctuations of the water surface. The two principal ways of measuring the velocity of a stream are by floats and current meters.

Great care is taken in the selection and equipment of gaging stations for determining discharge by velocity measurements, in order that the data may have the required degree of accuracy. Their essential requirements are practically the same, whether the velocity is determined by meters or floats. They are located, as far as possible, where the channel is straight both above and below the gaging section; where there are no cross currents, backwater, or boils; where the bed of the stream is reasonably free from large projections of a permanent character, and where the banks are high and subject to overflow only at flood stages. The station must be so far removed from the effects of tributary streams and of dams or other artificial obstructions that the gage height shall be an index of the discharge.

Certain permanent or semipermanent structures, usually referred to as "equipment," are generally pertinent to a gaging station. These are a gage for determining the fluctuations of the water surface, bench marks to which the datum of the gage is referred, permanent marks on a bridge or a tagged line indicating the points of measurement, and, where the current is swift, some appliance (generally a secondary cable) to hold the meter in position in the water. As a rule the stations are located at bridges if the channel conditions are satisfactory, as from them the observations can more readily be made and the cost of the equipment is small.

The floats in common use are the surface, subsurface, and tube or rod floats. A corked bottle with a flag in the top and weighted at the bottom makes one of the most satisfactory surface floats, as it is affected but little by wind. In case of flood measurements good results can be obtained by observing the velocity of floating cakes of ice or débris. In case of all surface-float measurements coefficients must be used to reduce the observed velocity to the mean velocity. The subsurface and tube or rod floats are intended to give directly the mean velocity in the vertical. Tubes give excellent results when the channel conditions are good, as in canals.

In measuring velocity by a float, observation is made of the time taken by the float to pass over the "run," a selected stretch of river from 50 to 200 feet long. In each discharge measurement a large number of velocity determinations are made at different points across the stream, and from these observations the mean velocity for the whole section is determined. This may be done by plotting the mean positions of the floats, as indicated by the distances from the bank, as ordinates and the corresponding times as abscissas. A curve through these points shows the mean time of run at any point across the stream, and the mean time for the whole stream is obtained by dividing the area bounded by this curve and its axis by the width. The length of the run divided by the mean time gives the mean velocity.

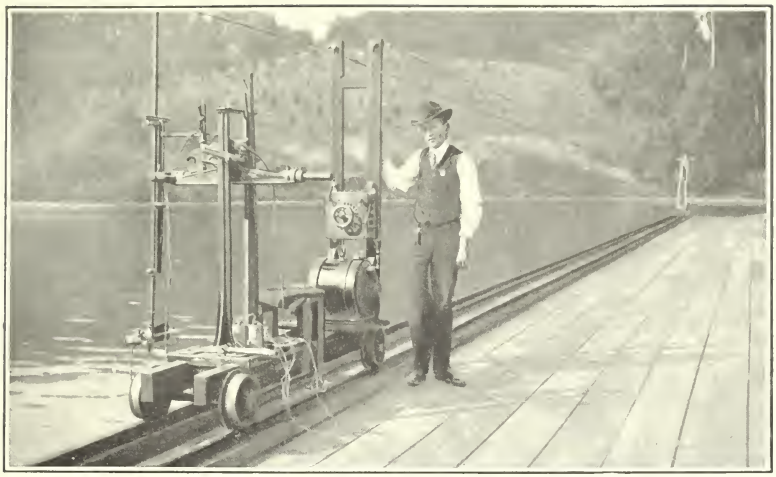
The area used in float measurements is the mean of the areas at the two ends of the run and at several intermediate sections.

The essential parts of the current meters in use are a wheel of some type, so constructed that the impact of flowing water causes it to revolve, and a device for recording or indicating the number of revolutions. The relation between the velocity of the moving water and the revolutions of the wheel is determined for each meter. This rating is done by drawing the meter through still water for a given distance at different speeds and noting the number of revolutions for each run. From these data a rating table is prepared which gives the velocity per second for any number of revolutions.

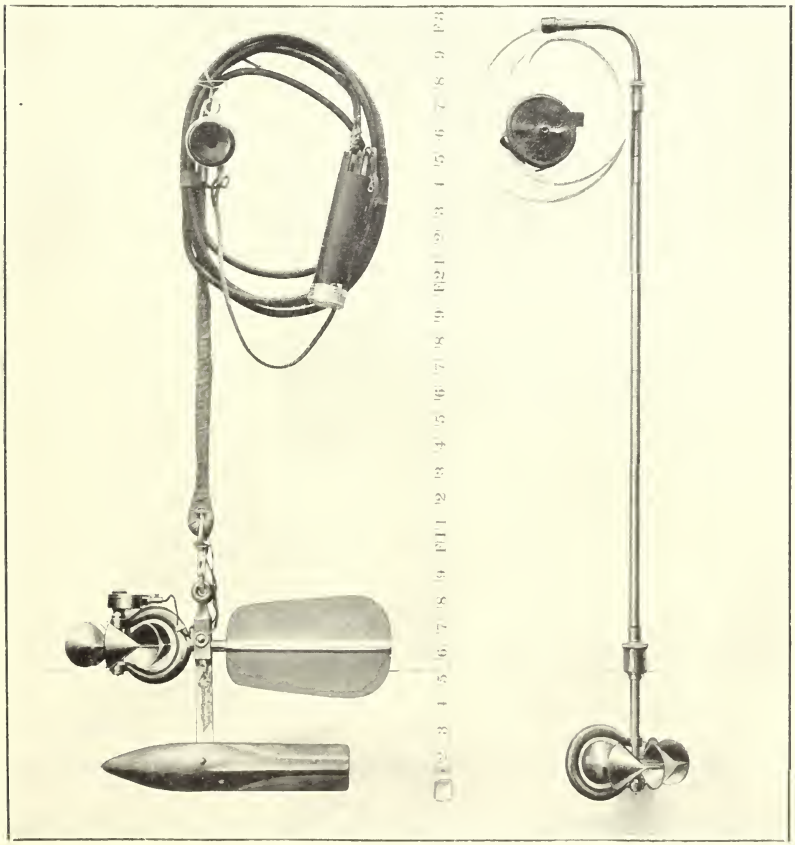
Many kinds of current meters have been constructed. They may, however, be classed in two general types—those in which the wheel is made up of a series of cups, as the Price, and those having a screw-propeller wheel, as the Haskell. Each meter has been developed for use under some special condition. In the case of the small Price meter, shown in Pl. II, *B*, which has been largely developed and extensively used by the United States Geological Survey, an attempt has been made to get an instrument which could be used under practically all conditions.

Current-meter measurements may be made from a bridge, cable, boat, or by wading, and gaging stations may be classified in accordance with such use. Fig. 1 shows a typical cable station.

In making the measurement an arbitrary number of points are laid off on a line perpendicular to the thread of the stream. The points at which the velocity and depth are observed are known as measuring points, and are usually fixed at regular intervals, varying from 2 to 20 feet, depending on the size and condition of the stream. Perpendiculars dropped from the measuring points divide the gaging section into strips. For each strip or pair of strips the mean velocity, area, and discharge are determined independently, so that conditions existing



A. CURRENT-METER RATING STATION AT LOS ANGELES, CAL.



B. PRICE CURRENT METERS.

in one part of the stream may not be extended to parts where they do not apply.

Three classes of methods of measuring velocity with current meters are in general use—multiple-point, single-point, and integration.

The three principal multiple-point methods in general use are the vertical velocity-curve; 0.2 and 0.8 depth; and top, bottom, and mid-depth.

In the vertical velocity-curve method a series of velocity determinations are made in each vertical at regular intervals, usually from 0.5 to 1 foot apart. By plotting these velocities as abscissas and their depths as ordinates, and drawing a smooth curve among the resulting points, the vertical velocity-curve is developed. This curve shows graphically the magnitude and changes in velocity from the surface to the bottom of the stream. The mean velocity in the vertical is then obtained by dividing the area bounded by this velocity-curve and its axis by the depth. On account of the length of time required to

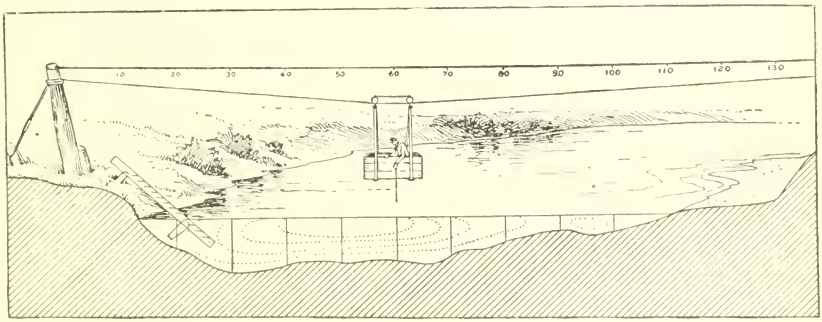


FIG. 1.—Cable station, showing section of river, car, gage, etc.

make a complete measurement by this method, its use is limited to the determination of coefficients for purposes of comparison and to measurements under ice.

In the second multiple-point method the meter is held successively at 0.2 and 0.8 of the depth, and the mean of the velocities at these two points is taken as the mean velocity for that vertical. On the assumption that the vertical velocity-curve is a common parabola with horizontal axis, the mean of the velocities at 0.22 and 0.79 of the depth will give (closely) the mean velocity in the vertical. Actual observations under a wide range of conditions show that this second multiple-point method gives the mean velocity very closely for open-water conditions, and moreover the indications are that it holds nearly as well for ice-covered rivers.

In the third multiple-point method the meter is held at mid-depth, at 0.5 foot below the surface, and at 0.5 foot above the bottom, and the mean velocity is determined by dividing by 6 the sum of the top

velocity, four times the mid-depth velocity, and the bottom velocity. This method may be modified by observing at 0.2, 0.6, and 0.8 depth.

The single-point method consists in holding the meter either at the depth of the thread of mean velocity, or at an arbitrary depth for which the coefficient for reducing to mean velocity has been determined.

Extensive experiments by vertical velocity-curves show that the thread of mean velocity generally occurs at from 0.5 to 0.7 of the total depth. In general practice the thread of mean velocity is considered to be at 0.6 depth, at which point the meter is held in a majority of the measurements. A large number of vertical velocity-curve measurements, taken on many streams and under varying conditions, show that the average coefficient for reducing the velocity obtained at 0.6 depth to mean velocity is practically unity.

In the other principal single-point method the meter is held near the surface, usually 1 foot below, or low enough to be out of the effect of the wind or other disturbing influences. This is known as the subsurface method. The coefficient for reducing the velocity taken at the subsurface to the mean has been found to be from 0.85 to 0.95, depending on the stage, velocity, and channel conditions. The higher the stage the larger the coefficient. This method is specially adapted for flood measurements, or when the velocity is so great that the meter can not be kept at 0.6 depth.

The vertical-integration method consists in moving the meter at a slow, uniform speed from the surface to the bottom and back again to the surface, and noting the number of revolutions and the time taken in the operation. This method has the advantage that the velocity at each point of the vertical is measured twice. It is useful as a check on the point methods.

The area, which is the other factor in the velocity method of determining the discharge of a stream, depends on the stage of the river, which is observed on the gage, and on the general contour of the bed of the stream, which is determined by soundings. The soundings are usually taken at each measuring point at the time of the discharge measurement, either by using the meter and cable or by a special sounding line or rod. For streams with permanent beds standard cross sections are usually taken during low water. These sections serve to check the soundings which are taken at the time of the measurements, and from them any change which may have taken place in the bed of the stream can be detected. They are also of value in obtaining the area for use in computations of high-water measurements, as accurate soundings are hard to obtain at high stages.

In computing the discharge measurements from the observed velocities and depths at various points of measurement, the measuring section is divided into elementary strips, as shown in fig. 1, and the mean velocity, area, and discharge are determined separately for either

a single or a double strip. The total discharge and the area are the sums of those for the various strips, and the mean velocity is obtained by dividing the total discharge by the total area.

The determination of the flow of an ice-covered stream is difficult, owing to diversity and instability of conditions during the winter period and also to lack of definite information in regard to the laws of flow of water under ice. The method now employed is to make frequent discharge measurements during the frozen periods by the 0.2 and 0.8, and vertical velocity-curve methods, and to keep an accurate record of the conditions, such as the gage height to the surface of the water as it rises in a hole cut in the ice, the thickness and character of the ice, etc.

From these data an approximate estimate of the daily flow can be made by constructing a rating curve (really a series of curves) similar to that used for open channels, but considering, in addition to gage heights and discharge, the varying thickness of ice. For information in regard to flow under ice cover see Water-Supply Paper No. 187.

OFFICE METHODS OF COMPUTING RUN-OFF.

There are two principal methods of determining run-off, depending on whether or not the bed of the stream is permanent.

For stations on streams with permanent beds the first step in computing the run-off is the construction of a rating table, which shows the discharge corresponding to any stage of the stream. This rating table is applied to the record of stage to determine the amount of water flowing. The construction of the rating table depends on the method used in measuring flow.

For a station at a weir or dam the basis for the rating table is some standard weir formula. The coefficients to be used in its application depend on the type of dam and other conditions near its crest. After inserting in the weir formula the measured length of crest and the assumed coefficient the discharge is computed for various heads and the rating table constructed.

The data necessary for the construction of a rating table for a velocity-area station are the results of the discharge measurements, which include the record of stage of the river at the time of measurement, the area of the cross section, the mean velocity of the current, and the quantity of water flowing. A thorough knowledge of the conditions at and in the vicinity of the station is also necessary.

The construction of the rating table depends on the following laws of flow for open, permanent channels: (1) The discharge will remain constant so long as conditions at or near the gaging station remain constant; (2) the discharge will be the same whenever the stream is at a given stage if the change of slope due to the rise and fall of the stream be neglected; (3) the discharge is a function of and increases gradually with the stage.

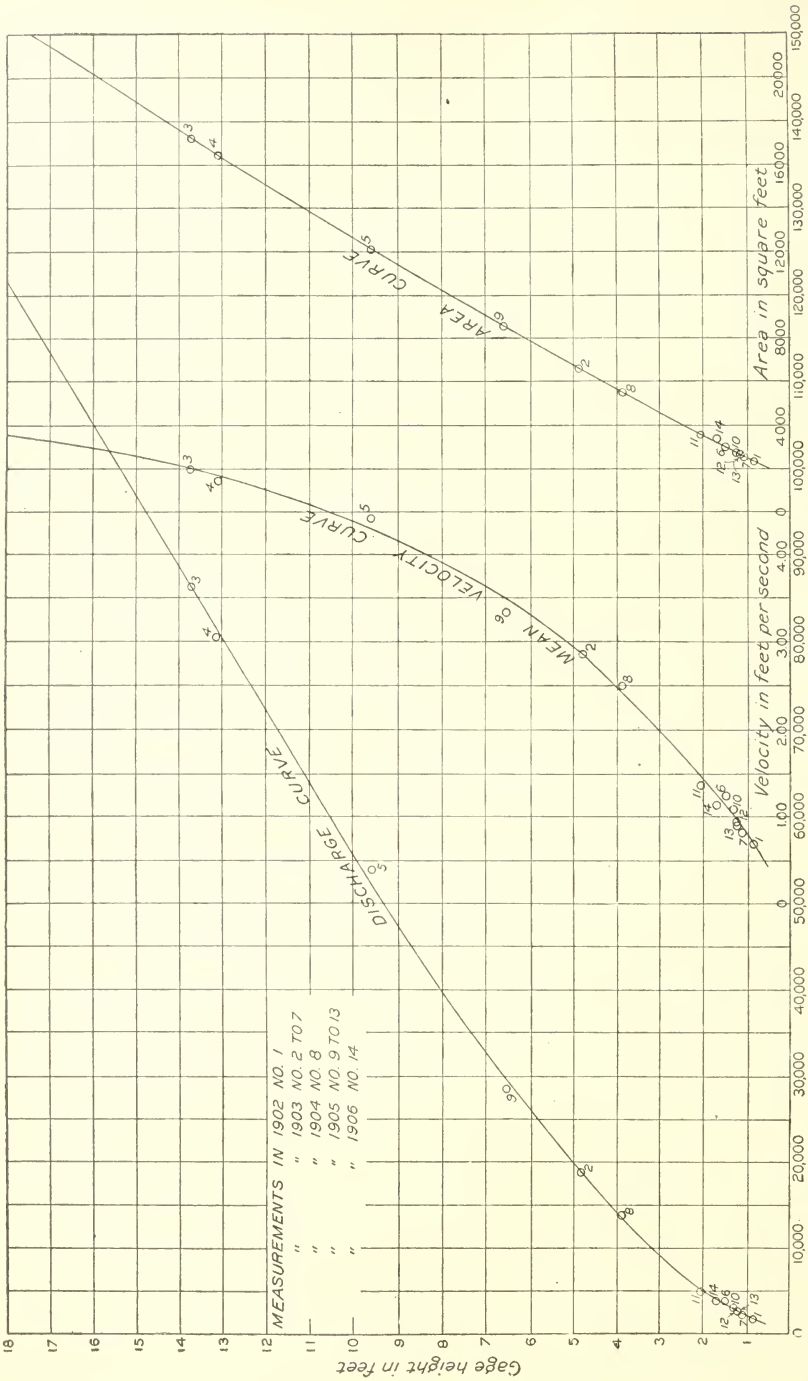


FIG. 2.—Discharge, area, and mean-velocity curves for Potomac River at Point of Rocks, Md.

The plotting of results of the various discharge measurements, using gage heights as ordinates, and discharge, mean velocity, and area as abscissas, will define curves which show the discharge, mean velocity, and area corresponding to any gage height. For the development of these curves there should be, therefore, a sufficient number of discharge measurements to cover the range of the stage of the stream. Fig. 2 shows a typical rating curve with its corresponding mean-velocity and area curves.

As the discharge is the product of two factors, the area and the mean velocity, any change in either factor will produce a corresponding change in the discharge. Their curves are therefore constructed in order to study each independently of the other.

The area curve can be definitely determined from accurate soundings extending to the limits of high water. It is always concave toward the horizontal axis or on a straight line, unless the banks of the stream are overhanging.

The form of the mean-velocity curve depends chiefly on the surface slope, the roughness of the bed, and the cross section of the stream. Of these, the slope is the principal factor. In accordance with the relative changes of these factors the curve may be either a straight line, convex or concave toward either axis, or a combination of the three. From a careful study of the conditions at any gaging station the form which the vertical velocity-curve will take can be predicted, and it may be extended with reasonable certainty to stages beyond the limits of actual measurements. Its principal use is in connection with the area curve in locating errors in discharge measurements and in constructing the rating table.

The discharge curve is defined primarily by the measurements of discharge, which are studied and weighted in accordance with the local conditions existing at the time of each measurement. The curve may, however, best be located between and beyond the measurements by means of curves of area and mean velocity. The discharge curve under normal conditions is concave toward the horizontal axis and is generally parabolic in form.

In the preparation of the rating table the discharge for each tenth or half tenth on the gage is taken from the curve. The differences between successive discharges are then taken and adjusted according to the law that they shall either be constant or increasing.

The determination of daily discharge of streams with changeable beds is a difficult problem. In case there is a weir or dam available, a condition which seldom exists on streams of this class, the discharge can be determined by its use. In case of velocity-area stations frequent discharge measurements must be made if the determinations of flow are to be other than rough approximations. For stations with beds which shift slowly or are materially changed only during floods

rating tables can be prepared for periods between such changes and satisfactory results obtained with a limited number of measurements, provided that some of them are taken soon after the change occurs. For streams with continually shifting beds, such as the Colorado and Rio Grande, discharge measurements should be made every two or three days and the discharges for intervening days obtained either by interpolation modified by gage height or by Professor Stout's method, which has been described in full in the Nineteenth Annual Report of the United States Geological Survey, Part IV, page 323, and in the Engineering News of April 21, 1904. This method, or a graphical application of it, is also much used in determining the flow at stations where the bed shifts but slowly.

COOPERATION AND ACKNOWLEDGMENTS.

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GENERAL DESCRIPTION OF THE GREAT BASIN.

In the interior of the North American continent, west of the Rocky Mountains, is an immense area known as the Great Basin, the streams of which do not discharge to the ocean. The area is not one single drainage basin, but consists rather of a number of basins, some of which are connected and others closed; the outer rim of all, however, is at such an elevation that the region as a whole has no surface outlet.

In outline the Great Basin is rudely triangular. Its western border is the Sierra Nevada, its northern the Columbia plateaus, its eastern the Rocky Mountains and the Colorado plateaus, while its southern extremity extends almost to the Gulf of California. This inclosed area is approximately 800 miles long from north to south, 500 miles broad at its widest part, and has been estimated to include 208,000 square miles. It comprises the western part of Utah, almost all of Nevada, and contiguous parts of Idaho, Oregon, and California.

Topographically this interior drainage area is characterized by isolated, narrow mountain ranges, trending north and south, which are separated by broad valleys varying considerably in altitude. In the southern part the valleys are low, Death Valley being below sea level,

while in the north the valleys have a general elevation of from 4,000 to 5,000 feet. The intervening highlands often rise several thousand feet above their bases, and some of the peaks of the bordering ranges attain elevations of 13,000 feet above sea level.

Upper branches of the intermontane valleys extend into the interior ranges as narrow drainage ways that are dry during most of the year; but the drainage from the high mountains on the east and west borders of the basin passes through deep canyons into the broad valleys, where the perennial streams maintain lakes. Among these are Great Salt, Utah, and Sevier lakes in the eastern part, and Pyramid, Winnemucca, Honey, Walker, Mono, and Owens lakes in the western part of the Great Basin. With the exception of Utah Lake, which discharges by Jordan River into Great Salt Lake, these lakes are saline in character, as a consequence of the concentration of salts due to evaporation. Bear Lake, in the mountains of the eastern border, and Lake Tahoe, in the Sierras, are large bodies of fresh water that drain, respectively, to Great Salt and Pyramid lakes. Shallow, temporary bodies of water accumulate in some of the broad intermontane valleys during the wet season, but completely evaporate during the summer, leaving muddy plains called playas.

Geologically the Great Basin is well known as the type region of the "Basin Range structure." Many of the isolated, narrow mountain ranges that trend north and south are steep on one side, exposing cross sections of the rocks, and sloping on the other, conforming with the dip of the strata. These ranges have been uplifted by movements of the earth's crust which have broken it into tilted blocks. The greatest displacements of the Great Basin are associated with the eastern and western borders, the Wasatch Mountains and the Sierra Nevada having been uplifted many thousand feet. The mountains of the Great Basin are commonly composed of Paleozoic strata, often modified by volcanism, and the products of weathering and disintegration of these rocks have accumulated in the broad intervening valleys, which are strewn to great depths with unconsolidated débris.

The climate of the Great Basin is extremely arid, and except a few favored spots where irrigation is practiced, the region in general is a desert. Over the larger part of the area the annual precipitation is less than 10 inches, but it is greater on the bordering high lands, especially on the Sierra Nevada, where it is over 40 inches. Temperature varies widely, owing to the large extent of the area and to differences in elevation. Over most of the region the heat of the summer days is intense, but the diurnal variation is considerable. Evaporation is enormous. From the surface of water in the vicinity of Salt Lake City it amounts to about 60 inches in a year, and over the major part of the Great Basin it is much greater, amounting in places possibly to 150 inches.

An arid climate, however, has not always prevailed in this region. In late geologic time (early Quaternary) the bordering high mountains supported glaciers, and enormous lakes, the old shore lines of which are now plainly marked on the sides of many valleys, accumulated in the Great Basin. The two largest of these lakes have been named after early explorers. Lake Bonneville occupied a considerable part of western Utah, its shrunken remnants being represented by Sevier, Utah, and Great Salt lakes; and Lake Lahontan covered an immense area in western Nevada.

The chief rivers of the Great Basin rise in the mountains which form its eastern and western borders and receive their principal supply from melting snow. The nature of the stream discharge is characteristic; the maximum commonly occurs in late spring or early summer, after which the flow decreases, reaching a minimum during the winter months. After leaving the mountains the streams receive little or no increment; in the broad, waste-filled valleys evaporation and seepage cause diminution in size, and often they entirely cease to flow.

For convenience of treatment, the drainage of the Great Basin has been divided into four areas, viz, Wasatch Mountains, Humboldt Sink, Sierra Nevada, and Great Basin drainage in Oregon. The data collected in these areas during 1906 are given in the following pages.

WASATCH MOUNTAINS DRAINAGE.

PRINCIPAL STREAMS.

The Wasatch Mountains drainage area includes the western half of Utah and small portions of Idaho and Wyoming. The headwaters of the various streams lie either in the Wasatch Mountains or in the plateaus to the south, and they drain either into Great Salt Lake or Sevier Lake. The following are the principal rivers of the area:

Bear and Weber rivers, discharging into Great Salt Lake.

City, Parleys, Emigration, Mill, and Big and Little Cottonwood creeks, tributary to Jordan River and thus to Great Salt Lake. These creeks have small watersheds, but in the mountain courses maintain perennial flows. On reaching the main valley they are extensively used for irrigation and the first three furnish the chief water supply for Salt Lake City.

American Fork, Hobble Creek, Spanish Fork, and Provo River, discharging into Utah Lake.

Sevier River, with its tributary, San Pitch River, draining into Sevier Lake.

BEAR RIVER BASIN.

DESCRIPTION OF BASIN.

Bear River rises on the northern slope of the Uinta Mountains, in the northeastern part of Utah, and after a circuitous course—in

which it leaves Utah and enters Wyoming, reenters Utah, appears again in Wyoming, and makes a long detour in Idaho—it returns again to Utah and finally discharges its waters into Great Salt Lake. The maximum elevation of the upper rim of the basin is 13,000 feet.

In the upper part of its course, above the Dingle gaging station, the country is rough and broken, the rocks of the extreme headwater regions being principally sandstone and quartzite, covered with a thin layer of soil which supports scattered groves of fir and aspen. Farther down the prevailing formation is a compact limestone covered with a clayey soil, generally dry and with a rank growth of sagebrush. The tributary streams are numerous and well distributed, but they are generally short and confined to steep, narrow canyons. There are no marshes, extensive meadows, or forests, but a few small lakes lie near the head of the river. Numerous small springs and the melting snow which comprises the greater part of the precipitation are the chief sources of supply. The annual high-water period occurs during May and June, and the stream is not subject to quick floods or freshets.

Just below Dingle the main stream passes through the north end of Bear Lake Valley in a well-defined channel with no overflow, and from this point to Preston it is confined largely to a steep, narrow canyon, with occasional small, narrow valleys containing irrigated farms. The tributaries in this portion of the basin are few, the principal ones being Mink and Cottonwood creeks. About 10 miles below Dingle the outlet to Bear Lake joins the river. This is a small, crooked, sluggish stream, that discharges but little water at any time, though it is the only visible outlet to Bear Lake, which has an area of about 144 square miles.

The total unappropriated flow between Dingle and Preston is used for irrigation. There is no storage on the main stream, but on Mink Creek a number of small storage reservoirs are contemplated or in process of construction, the water to be diverted for the irrigation of lands in the northwest end of Cache Valley.

Between Preston and Collinston the Bear is a sluggish stream, traversing the west side of Cache Valley in a well-defined channel, which during extreme floods overflows slightly and covers a very narrow strip immediately along the river. The principal tributary streams in this portion of the course are Cub Creek and Logan River. The former has its source in the Bear River Range, and drains a rough country of limestone with but little overlying soil. The creek is confined to a steep, narrow canyon until it reaches Cache Valley, where it flows sluggishly for about 15 miles through a winding, but well-defined, channel into Bear River. It discharges considerable water into the main stream during flood and winter seasons, but its entire summer flow is used for irrigation in the north end of Cache

Valley. A gaging station was maintained during a part of 1900 and 1901 on Cub Creek about 4 miles northeast of Franklin, at the mouth of the canyon, but, owing to unfavorable conditions, it was discontinued.

Logan River enters the Bear about 7 miles above the gaging station at Collinston, a short distance above the point where it leaves Cache Valley and enters the canyon.

Practically the only inflow to the Bear in Cache Valley is from seepage and springs. The lower portions of the valley form an artesian basin containing numerous small, flowing wells. The water table lies very near the surface, and during the early spring the lower lands are largely swamp.

The Bear River Canal Company diverts the entire summer flow of the stream above Collinston onto agricultural lands lying on both sides of the river below Bear River Canyon. This system has a capacity of about 1,000 second-feet, and during the winter and flood seasons a part of the water is used to develop electric power at a point about one-fourth mile above the Collinston station, being returned to the river at Collinston. From 10 to 30 second-feet reach the stream through leaks and as seepage from the diversion canals.

Owing to the complete control of the stream by irrigation works, the discharge is liable to extreme variation at any period.

BEAR LAKE AT FISHHAVEN, IDAHO.

This station was established October 5, 1903. It is located at Fishhaven, Idaho, on the west shore of Bear Lake, about 4 miles north of the Idaho-Utah State line. It is on land used as a summer resort, owned by G. C. Gray, of Montpelier, Idaho, and is immediately south of the summer resort known as Nelsons Camp. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 19.

Daily gage height, in feet, of Bear Lake at Fishhaven, Idaho, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1							17	1.9					
2						3.4	18						
3							19					3.3	
4							20						
5		1.9			3.0		21				2.8		
6							22						
7	1.85			2.4			23		2.0				3.5
8			2.05				24	1.9					
9						3.5	25						
10							26					3.4	
11							27						
12					3.2		28		2.0		2.8		
13							29						
14		1.95		2.6			30						3.5
15							31						
16						3.55							

BEAR RIVER AT DINGLE, IDAHO.

This station was established May 9, 1903. It is located in a cut made by the Oregon Short Line Railroad Company one-fourth mile east of the Dingle railroad station and about 250 feet south of the track. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 20, where are given also references to publications that contain data for previous years.

Discharge measurements of Bear River at Dingle, Idaho, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 25[a]	W. G. Swendsen	88	159	4.61	212
May 30	H. S. Kleinschmidt	122	609	7.40	2,690
August 17	Thos. Grieve, jr.	107	188	3.90	276

[a] Ice 1.2 feet thick at the gage.

Daily gage height, in feet, of Bear River at Dingle, Idaho, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1		3.5		5.5	5.0	7.55	5.45	4.3	4.4	4.0	4.0	4.2
2				5.2	5.0	7.55	5.45	4.3	4.4	4.0	4.0	4.2
3	3.7			5.2	4.9	7.6	5.4	4.25	4.4	3.95	4.0	4.1
4		3.4	4.4	5.2	4.9	7.6	5.3	4.2	4.4	3.95	4.0	4.0
5				5.2	5.0	7.45	5.3	4.2	4.5	3.95	3.95	4.0
6	3.1			5.0	5.2	7.2	5.4	4.2	4.55	3.95	4.0	4.0
7		3.1		5.2	5.2	7.0	5.4	4.2	4.55	3.95	4.0	4.0
8			4.4	5.3	5.2	7.0	5.1	4.2	4.5	3.9	4.0	4.0
9				5.0	5.2	6.95	5.1	4.2	4.4	3.9	4.0	4.0
10	3.3	3.4		5.0	5.3	6.9	5.2		4.4	3.9	4.0	4.0
11				5.0	5.4	6.95	5.1	4.1		3.9	4.0	4.0
12			4.6	5.1	5.55	6.8	5.1	4.05	4.25	3.9	4.0	4.05
13				5.2	5.8	6.6	5.1	4.0	4.2	3.9	3.95	4.1
14	3.7	4.0		5.1	6.0	6.55	5.2	4.0	4.2	3.9	4.0	4.05
15				5.1	6.2	6.6	5.2	4.0	4.2	3.9	4.0	4.2
16			4.6	5.0	6.4	6.6	5.1	3.9	4.2	3.9	4.0	4.3
17	4.0			5.0	6.7		5.3		4.2	3.9	4.0	4.0
18				5.0	6.7	6.75	5.2	3.9	4.2	3.9	3.95	4.2
19		4.5	4.5	5.0	6.55	6.8	5.0	3.85	4.2	3.9	3.8	4.1
20	4.0			5.2	6.45	6.8	4.9	4.1	4.15	3.9		4.1
21				5.2	6.3	6.8	4.75	4.2	4.15	3.9	3.95	4.1
22		4.6	4.6	5.2	6.3	6.8	4.7	4.3	4.15	3.9	4.5	4.1
23	3.8			5.3	6.25	6.7	4.7	4.5	4.1	3.9	4.1	4.2
24				5.3	6.3	6.5	4.7	4.4	4.1	3.8		4.0
25		4.6	4.7	5.3	6.45	6.3	4.5	4.45	4.1	3.85	4.2	4.2
26				5.3	6.6	6.15	4.5	4.6	4.0	3.9	4.2	4.1
27				5.3	6.8	6.1	4.5	4.65		3.95	3.9	4.1
28	3.65	4.6	4.4	5.25	7.0	5.95	4.5	4.6	4.0	3.9	3.85	4.1
29				5.2	7.2	5.7	4.4	4.5	4.0	3.9	3.9	4.1
30			5.6	5.1	7.4	5.6	4.3	4.45	4.0	3.95	4.0	4.1
31			5.65		7.5		4.3	4.4		4.0		

NOTE.—Ice conditions January 1 to March 30 and November 22 to December 31. Ice thicknesses were recorded as follows:

Thickness of ice.

Date.	Thickness.	Date.	Thickness.
	Feet.		*Feet.*
January 19, 17, and 20	0.8	February 25 and 28	1.2
January 23	1.0	March 4, 8, 12, 16, and 19	1.0
January 28	.9	March 22 and 25	.8
February 1	.8	March 28	.6
February 4	1.0	March 30	(a)
February 7	1.1	November 22	(a)
February 10 and 14	1.2	December 23	(b)
February 19 and 22	1.0		

[a] Ice gorged.

[b] Ice 0.5 foot thick.

Rating table for Bear River at Dingle, Idaho, for 1904–1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.10	60	3.90	260	4.70	590	5.50	1,020	6.60	1,910
3.20	75	4.00	295	4.80	635	5.60	1,085	6.80	2,090
3.30	90	4.10	330	4.90	685	5.70	1,155	7.00	2,275
3.40	110	4.20	370	5.00	740	5.80	1,230	7.20	2,455
3.50	135	4.30	410	5.10	790	5.90	1,300	7.40	2,635
3.60	160	4.40	455	5.20	840	6.00	1,375	7.60	2,815
3.70	190	4.50	495	5.30	895	6.20	1,550	7.80	2,995
3.80	225	4.60	540	5.40	955	6.40	1,730	8.00	3,175

NOTE.—The above table is applicable only for open-channel conditions. It is based upon 13 discharge measurements made during 1903–1906, and is well defined between gage heights 3.50 feet and 7.40 feet. Above gage height 6.19 feet the rating curve is a tangent, the difference being 90 per tenth.

Monthly discharge of Bear River at Dingle, Idaho, for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	1,020	740	825	49,100
May	2,720	685	1,480	91,000
June	2,820	1,080	2,050	122,000
July	988	410	732	45,000
August	565	242	385	23,700
September	517	295	389	23,100
October	295	225	266	16,400
November 1–21	295	225	287	12,000
The period				382,000

BEAR RIVER NEAR PRESTON, IDAHO.

This station was established October 11, 1889. It is located about 6 miles from Preston, Idaho, 10 miles north of the Idaho-Utah boundary line and about 300 feet below the county road crossing at the old bridge of the Oregon Short Line Railroad. The data collected at this station are of extreme importance as showing the amount of water that passes from Idaho into Utah and will be of great value in the final adjudication of water rights on the stream. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 22, where are given also references to publications that contain data for previous years.

Discharge measurements of Bear River near Preston, Idaho, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 24	W. G. Swendsen	184	320	1.27	584
April 12	H. S. Kleinschmidt	198	695	3.41	2,450
May 23	Thos. Grieve, jr	201	772	3.79	3,110
July 28	do	191	397	1.54	687

Daily gage height, in feet, of Bear River near Preston, Idaho, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.40	1.25	2.70	3.20	4.45	2.78	1.38	1.85	1.30	1.30	1.30
2	.....	1.35	1.20	2.70	3.12	4.40	2.68	1.30	1.85	1.05	1.55	1.55
3	.....	1.35	1.20	2.55	2.95	4.40	2.58	1.28	1.85	1.04	1.55	1.36
4	.....	1.30	1.20	2.50	3.00	4.42	2.52	1.22	1.80	1.04	1.55	1.07
5	.....	1.40	1.20	2.58	3.00	4.48	2.50	1.20	1.80	1.04	1.55	1.07
6	2.90	1.35	1.22	2.62	2.95	4.70	2.42	1.15	1.75	1.04	1.55	1.07
7	.....	1.52	1.22	2.90	2.90	4.68	3.32	1.10	1.75	1.04	1.55	1.07
8	.....	1.68	1.25	3.35	2.90	4.58	2.22	1.10	1.75	1.24	1.55	1.07
9	.....	1.40	1.30	3.42	2.90	4.50	2.30	1.05	1.75	1.45	1.55	1.07
10	.....	1.20	1.30	3.60	2.90	4.48	2.28	1.00	1.75	1.45	1.55	1.07
11	.....	1.12	1.30	3.60	2.90	4.38	2.22	1.00	1.75	1.24	1.55	1.07
12	3.00	1.05	1.30	3.40	2.90	4.25	2.18	1.00	1.70	1.04	1.55	1.07
13	.....	1.05	1.30	3.40	3.28	4.12	2.10	.95	1.65	1.04	1.55	1.07
14	.....	1.05	1.30	3.52	3.40	4.05	2.10	.90	1.68	1.04	1.55	1.07
15	.....	1.05	1.30	3.65	3.82	4.00	2.10	.90	1.70	1.04	1.55	1.07
16	.....	1.12	1.30	3.70	3.88	3.95	2.08	.85	1.60	1.04	1.55	1.07
17	.....	1.20	1.35	3.82	3.80	3.85	2.00	.85	1.06	1.04	1.55	1.07
18	.....	1.20	1.35	3.72	3.80	3.80	1.95	.85	1.06	1.04	1.07	1.07
19	.....	1.38	1.60	3.70	3.80	3.72	1.88	.85	1.30	1.04	1.07	1.07
20	1.60	1.35	1.60	3.62	3.80	3.68	1.80	.85	1.55	1.04	1.07	1.07
21	1.60	1.35	1.40	3.60	3.80	3.52	1.75	.90	1.55	1.04	1.07	1.07
22	1.62	1.30	1.40	3.52	3.80	3.32	1.70	.95	1.30	1.04	1.07	1.07
23	1.35	1.25	1.55	3.50	3.80	3.30	1.65	1.02	1.05	1.04	1.07	1.07
24	1.30	1.25	1.90	3.50	3.85	3.30	1.60	1.05	1.05	1.04	1.07	1.07
25	1.25	1.25	2.25	3.45	4.00	3.32	1.60	1.06	1.05	1.04	1.07	1.07
26	1.30	1.25	2.15	3.42	4.20	3.28	1.60	1.68	1.05	1.04	1.07	1.75
27	1.35	1.25	1.90	3.40	4.42	3.18	1.60	1.72	1.05	1.04	1.07	1.08
28	1.40	1.25	1.92	3.32	4.52	3.08	1.58	1.78	1.05	1.04	1.05	1.75
29	1.30	.....	1.95	3.20	4.50	2.98	1.52	1.85	1.55	1.04	1.05	1.41
30	1.28	.....	1.98	3.20	4.60	2.88	1.48	1.85	1.55	1.04	1.05	1.36
31	1.40	.....	2.20	.....	4.52	.....	1.40	1.85	.....	1.04	.....	1.65

NOTE.—River frozen January 1 to 19, February 7 to 10, and November 18 to 27. January 13 the ice was 1.15 feet thick, and the stream was nearly filled with needle ice.

Rating table for Bear River near Preston, Idaho, for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.50	158	1.20	418	1.90	855	2.60	1,510	3.60	2,840
.60	186	1.30	468	2.00	935	2.70	1,630	3.80	3,150
.70	217	1.40	522	2.10	1,020	2.80	1,750	4.00	3,470
.80	251	1.50	580	2.20	1,110	2.90	1,870	4.20	3,800
.90	288	1.60	642	2.30	1,205	3.00	1,990	4.40	4,140
1.00	328	1.70	708	2.40	1,300	3.20	2,260	4.60	4,480
1.10	371	1.80	779	2.50	1,400	3.40	2,540		

NOTE.—The above table is applicable only for open-channel conditions. It is based upon discharge measurements made during 1904–1906, and is well defined.

Monthly discharge of Bear River near Preston, Idaho, for 1906.

[Drainage area, 4,500 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January 20-31	655	443	523	12,400	0.116	0.05
February	695	350	459	25,500	.102	.11
March	1,160	418	607	37,300	.135	.16
April	3,180	1,400	2,430	145,000	.540	.60
May	4,480	1,870	2,870	176,000	.638	.74
June	4,650	1,850	3,350	199,000	.744	.83
July	2,430	522	1,020	62,700	.227	.26
August	817	270	428	26,300	.095	.11
September	817	350	603	35,900	.134	.15
October	551	345	368	22,600	.082	.09
November	611	350	496	29,500	.110	.12
December	744	358	420	25,800	.093	.11
The period	4,650	270	1,180	798,000	.262	3.33

NOTE.—The open-channel rating was applied to the frozen periods without correction, and the above values are liable to further error during the winter period owing to uncertainty regarding the ice conditions.

BEAR RIVER NEAR COLLINSTON, UTAH.

This station was established July 1, 1889. It is located 6 miles from Collinston station on the Oregon Short Line Railroad, about one-fourth mile below the electric-power plant in Bear River Canyon, and is at the lower end of the canyon separating Cache and Great Salt Lake valleys, at a point below all diversion from the stream. It shows the amount of unappropriated water that is discharged as waste into Great Salt Lake. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 25, where are given also references to publications that contain data for previous years.

Discharge measurements of Bear River near Collinston, Utah, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 22	W. G. Swendsen	272	598	2.05	1,490
May 23	Thos. Grieve, jr	288	1,120	4.30	4,420
June 20	do	290	1,180	4.35	4,660
July 26	do	268	305	1.25	621

Daily gage height, in feet, of Bear River near Collinston, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.35	1.4	1.85	3.05	3.8	5.75	3.15		2.1			1.9
2		1.45	1.75	3.4	3.75	5.85	3.0					
3	1.4	1.45	1.7	3.5	3.5	5.55	2.85				1.85	
4	1.4	1.45	1.6	3.25	3.8	5.45	2.7					
5	1.4	1.45	1.65	3.05	3.55	5.5	2.55					
6		1.5	1.65	3.1	3.6	5.5	2.45			1.65		
7	1.3	1.4	1.7	3.2	3.65	5.5	2.3					
8	1.2	1.35	1.7	3.25	3.55	5.55	2.1		1.95			2.1
9	1.2	1.35	1.75	3.55	3.55	5.6	1.95					
10	1.15	1.4	1.8	3.85	3.55	5.45	1.85				1.9	
11	1.2	1.4	1.95	3.85	3.6	5.3	2.1					
12	1.25	1.45	1.95	4.05	3.6	5.1	1.95					
13	1.25	1.45	2.55	3.95	3.7	4.95	1.9			1.65		
14	1.3	1.5	2.7	3.85	3.95	4.9	1.8					
15	1.35	1.6	2.3	3.85	4.1	4.85	1.75		2.25			2.05
16		1.8		3.9	4.3	4.75	1.7					
17	1.3	2.0	1.85	4.0	4.5	4.75	1.65				1.95	
18			1.8	4.15	4.5	4.7	1.55					
19	1.2		1.8	4.25	4.45	4.5	1.55					
20	1.15		1.8	4.25	4.35	4.35	1.55			1.7		
21	1.15	2.15	1.8	4.2	4.25	4.15	1.5					
22	1.8	2.1	1.85	4.15	4.25	3.95			1.8			2.6
23	1.65	2.0	2.1	4.1	4.2	3.85		2.3				
24	1.6	1.95	2.45	4.2	4.2	3.65					1.75	
25	1.55	1.95	3.3	4.25	4.25	3.5		2.2				
26	1.6	1.9	3.8	4.3	4.35	3.45	1.25					
27	1.75	1.8	3.55	4.25	4.4	3.35				1.8		
28	1.5	1.8	3.3	4.05	4.7	3.3						
29	1.45		3.05	3.75	4.95	3.25			1.65			2.25
30	1.4		2.9	3.55	5.25	3.15						
31	1.4		2.9		5.55							

NOTE.—Bear River seldom freezes over at this station, the only ice conditions being a narrow strip of ice along each bank during December and January.

Rating table for Bear River near Collinston, Utah, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	550	1.90	1,315	2.70	2,190	3.50	3,250	4.60	4,960
1.20	620	2.00	1,420	2.80	2,300	3.60	3,390	4.80	5,300
1.30	705	2.10	1,530	2.90	2,420	3.70	3,530	5.00	5,640
1.40	805	2.20	1,640	3.00	2,550	3.80	3,670	5.20	5,980
1.50	905	2.30	1,750	3.10	2,690	3.90	3,820	5.40	6,320
1.60	1,005	2.40	1,860	3.20	2,830	4.00	3,980	5.60	6,660
1.70	1,105	2.50	1,970	3.30	2,970	4.20	4,300	5.80	7,000
1.80	1,210	2.60	2,080	3.40	3,110	4.40	4,620		

NOTE.—The above table is applicable only for open-channel conditions. It is based upon discharge measurements made during 1904–1906, and is well defined.

Monthly discharge of Bear River near Collinston, Utah, for 1906.

[Drainage area, 6,000 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	1,210	585	783	48,100	0.130	0.15
February	1,580	755	1,100	61,100	.183	.19
March	3,670	1,000	1,700	105,000	.283	.33
April	4,460	2,620	3,700	220,000	.617	.69
May	6,580	3,250	4,210	259,000	.702	.81
June	7,080	2,760	5,090	303,000	.848	.95
July 1–21	2,760	905	1,530	63,700	.255	.20
The period				1,060,000		

NOTE.—Values for January and February may be slightly affected by ice.

LOGAN RIVER NEAR LOGAN, UTAH.

Logan River rises on the west slope of Bear River Range, flows southwest, then northwest, and unites with Bear River near Benson, Utah. The entire basin is rough and rugged, the elevations ranging from 4,500 to 9,000 feet, and the stream being confined largely to a steep and rough channel in a comparatively narrow canyon. Probably three-fourths of the precipitation in the basin is snow, the melting of which forms the chief source of supply for the spring and early summer flow. The late summer and winter flow is derived chiefly from springs, which are well distributed over the basin. In its upper course the stream has numerous small tributaries, all short and swift. Temple Fork and South Fork, which enter the river about 10 and 15 miles, respectively, above the gaging station, are perennial streams and furnish from one-third to one-fourth of the total flow. Blacksmith Fork comes in below the gaging station. There is no storage on the stream at present. The entire flow, after being utilized to furnish power at two electric plants near the mouth of the canyon, is used for irrigation.

A gaging station was established June 1, 1896, about 2 miles east of the city of Logan, near the mouth of the canyon. It was discontinued July 18, 1903, and reestablished April 13, 1904, at a point along the canyon road about 50 feet below the highway bridge, at the mouth of the canyon, 800 feet below the Hercules power house and about 1,000 feet above the old gaging station. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 28, where are given also references to publications that contain data for previous years.

About May 1, 1906, this station was moved by the Telluride Power Company to a point about 400 feet downstream. The gage is a 4 by 6 inch timber graduated to feet and tenths. It is set in an inclined position and is directly under the cable.

The description of the channel conditions, etc., is practically the same as given for the old station.

Discharge measurements of Logan River, near Logan, Utah, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 23	W. G. Swendsen	39	46.5	1.83	102
April 11	H. S. Kleinschmidt	67	68.0	2.24	244
May 5	do	46	95.0	2.80	587
May 23	Thos. Grieve, jr	60	130	3.27	779
June 21	do	63	130	3.30	779
July 27	do	48	77.4	2.53	268

Daily gage height, in feet, of Logan River near Logan, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.80	1.83	1.82	2.05	2.45	3.45	3.10	2.43	2.33	2.19	2.10	2.15
2	1.75	1.85	1.83	2.02	2.48	3.40	3.10	2.40	2.33	2.20	2.08	2.10
3	1.85	1.84	1.80	1.97	2.60	3.40	3.10	2.40	2.33	2.30	2.10	2.15
4	1.85	1.75	1.85	1.93	2.70	3.42	3.08	2.40	2.32	2.22	2.05	2.25
5	1.85	1.82	1.79	1.85	2.78	3.42	3.02	2.38	2.31	2.20	2.08	2.20
6	1.83	1.75	1.74	2.04	2.80	3.50	3.00	2.88	2.30	2.15	2.20	2.15
7	1.83	1.72	1.75	2.09	2.78	3.42	2.90	2.35	2.30	2.15	2.10	2.15
8	1.83	1.78	1.78	2.15	2.85	3.40	2.80	2.35	2.30	2.20	2.00	2.15
9	1.86	1.84	1.78	2.20	2.98	3.38	2.85	2.32	2.29	2.20	2.00	2.15
10	1.89	1.84	1.79	2.20	3.02	3.35	2.90	2.32	2.28	2.20	2.10	2.15
11	1.85	1.66	1.80	2.22	3.10	3.40	2.83	2.32	2.25	2.15	2.00	2.15
12	1.90	1.82	1.80	2.20	3.18	3.52	2.80	2.32	2.25	2.15	2.00	2.15
13	1.83	1.84	1.90	2.20	3.08	3.55	2.80	2.32	2.25	2.13	2.10	2.15
14	1.85	1.85	1.80	2.21	3.08	3.57	2.75	2.48	2.25	2.13	2.30	2.15
15	1.70	1.85	1.85	2.20	3.10	3.60	2.70	2.30	2.28	2.10	2.30	2.10
16	1.83	1.86	1.73	2.23	3.00	3.60	2.70	2.28	2.23	2.00	2.00	2.10
17	1.86	1.85	1.73	2.32	2.90	3.55	2.70	2.28	2.23	2.05	2.10	2.10
18	1.88	1.85	1.77	2.45	2.85	3.50	2.65	2.25	2.23	2.05	1.90	2.10
19	1.93	1.86	1.79	2.42	2.87	3.45	2.60	2.28	2.21	2.20	1.90	2.15
20	2.08	1.77	1.79	2.45	3.00	3.42	2.60	2.30	2.20	2.00	2.00	2.20
21	1.70	1.78	1.80	2.45	3.03	3.40	2.58	2.55	2.20	2.00	2.00	2.15
22	1.73	1.79	1.80	2.52	3.10	3.40	2.55	2.60	2.30	2.10	2.10	2.15
23	1.90	1.83	1.81	2.47	3.13	3.38	2.55	2.45	2.30	2.20	2.05	2.10
24	1.85	1.74	1.81	2.48	3.40	3.35	2.52	2.43	2.22	2.50	2.10	2.10
25	1.83	1.85	1.93	2.55	3.41	3.20	2.52	2.39	2.21	2.20	2.20	2.10
26	1.83	1.80	1.93	2.47	3.40	3.18	2.50	2.38	2.21	2.20	2.20	2.20
27	1.83	1.84	1.93	2.40	3.60	3.20	2.50	2.38	2.21	2.20	2.20	2.15
28	1.85	1.81	1.90	2.38	3.80	3.22	2.48	2.37	2.19	2.20	2.20	2.20
29	1.80	.....	1.93	2.37	3.70	3.15	2.45	2.35	2.18	2.15	2.20	2.15
30	1.79	.....	2.00	2.42	3.55	3.13	2.45	2.34	2.20	2.20	2.15	2.15
31	1.80	.....	2.00	.....	3.50	.....	2.45	2.33	.....	2.10	.....	.....

NOTE.—Stream does not freeze at this point during winter months; 5 second-feet were flowing into the river from the canal November 14 to December 31.

Rating table for Logan River near Logan, Utah, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.60	30	2.10	194	2.60	410	3.10	672	3.60	964
1.70	60	2.20	232	2.70	460	3.20	728	3.70	1,026
1.80	92	2.30	274	2.80	510	3.30	786	3.80	1,088
1.90	124	2.40	318	2.90	562	3.40	844		
2.00	158	2.50	362	3.00	616	3.50	904		

NOTE.—The above table is applicable only for open-channel conditions. It is based upon 6 discharge measurements made during 1906 and is fairly well defined.

Monthly discharge of Logan River near Logan, Utah, for 1906.

[Drainage area, 218 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	187	60	104	6,400	0.477	0.55
February	111	66	95	5,280	.436	.45
March	158	70	102	6,270	.468	.54
April	386	108	263	15,600	1.21	1.35
May	1,090	340	663	40,800	3.04	3.50
June	964	689	843	50,200	3.87	4.32
July	672	340	476	29,300	2.18	2.51
August	552	253	312	19,200	1.43	1.65
September	287	224	256	15,200	1.17	1.30
October	362	158	218	13,400	1.00	1.15
November	274	124	193	11,500	.885	.99
December	253	194	212	13,000	.972	1.12
The year	1,090	60	311	226,000	1.43	19.43

These discharges do not include the flow of Logan, Hyde Park, and Smithfield canal, which diverts water above the station.

BLACKSMITH FORK NEAR HYRUM, UTAH.

This stream rises on the western slope of the Bear River Range and flows southwest and then northwest into Logan River. The drainage basin of the tributary is in every way similar to that of the main stream. Only the flood and winter discharge, however, reaches the Logan, the entire spring and summer flow being used for irrigation on the tillable lands below the gaging station.

The gaging station was established July 19, 1900, near the tollgate in the mouth of the canyon near Hyrum, Utah, which is the nearest post-office. The station was discontinued December 31, 1902, and reestablished May 16, 1904, about 1,000 feet downstream from the tollgate and 800 feet above the Hyrum city electric-power plant. A station is also maintained at the power-plant race. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 31, where are given also references to publications contain data for previous years.

Discharge measurements of Blacksmith Fork near Hyrum, Utah, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 18	W. G. Swendsen	32.5	21.6	3.33	35
May 5	H. S. Kleinschmidt	40	54.7	4.08	184
May 23	Thos. Grieve, jr	40	51.3	3.90	150
June 21	do	39	46.6	3.85	116
July 22	do	38	37.4	3.59	72

Daily gage height, in feet, of Blacksmith Fork near Hyrum, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.3	3.3	3.4	3.5	3.9	4.4	3.7	3.6	3.6	3.5	3.4	3.3
2	3.3	3.3	3.4	3.4	3.9	4.4	3.7	3.6	3.6	3.5	3.4	3.3
3	3.3	3.4	3.3	3.4	3.9	4.3	3.7	3.6	3.6	3.5	3.4	3.3
4	3.4	3.4	3.3	3.4	4.1	4.2	3.7	3.6	3.6	3.5	3.4	3.3
5	3.4	3.3	3.3	3.4	4.1	4.1	3.7	3.6	3.5	3.5	3.4	3.3
6	3.4	3.3	3.3	3.4	4.1	4.2	3.7	3.6	3.5	3.5	3.4	3.3
7	3.3	3.3	3.3	3.4	4.1	4.3	3.6	3.6	3.5	3.5	3.4	3.3
8	3.3	3.3	3.3	3.7	4.1	4.3	3.6	3.6	3.5	3.5	3.4	3.3
9	3.3	3.3	3.3	3.8	4.2	4.2	3.6	3.5	3.5	3.5	3.4	3.3
10	3.4	3.3	3.3	3.8	4.2	4.1	3.6	3.5	3.5	3.5	3.4	3.3
11	3.3	3.3	3.35	3.7	4.2	4.1	3.6	3.5	3.5	3.5	3.4	3.4
12	3.4	3.3	3.35	3.7	4.2	4.1	3.6	3.5	3.5	3.5	3.4	3.4
13	3.4	3.3	3.3	3.7	4.2	4.1	3.6	3.5	3.5	3.5	3.4	3.4
14	3.3	3.3	3.3	3.6	4.2	4.1	3.6	3.5	3.5	3.5	3.4	3.4
15	3.4	3.3	3.3	3.6	4.2	3.9	3.6	3.5	3.5	3.5	3.3	3.4
16	3.4	3.3	3.3	3.6	4.2	3.9	3.6	3.5	3.5	3.5	3.3	3.4
17	3.3	3.3	3.3	3.8	4.2	3.9	3.6	3.5	3.5	3.5	3.3	3.4
18	3.4	3.3	3.3	3.8	4.1	3.9	3.6	3.5	3.5	3.5	3.3	3.4
19	3.4	3.3	3.3	3.9	3.9	3.9	3.6	3.5	3.5	3.5	3.3	3.4
20	3.3	3.3	3.3	3.9	4.1	3.9	3.6	3.7	3.5	3.5	3.3	3.4
21	3.4	3.3	3.3	4.2	3.9	3.9	3.6	3.7	3.5	3.45	3.3	3.4
22	3.4	3.3	3.3	4.2	3.9	3.9	3.6	3.7	3.5	3.45	3.3	3.4
23	3.3	3.3	3.3	4.2	3.9	3.8	3.6	3.7	3.5	3.45	3.3	3.4
24	3.3	3.3	3.3	4.2	3.8	3.8	3.6	3.6	3.5	3.45	3.3	3.4
25	3.3	3.3	3.3	3.9	3.8	3.8	3.6	3.6	3.5	3.45	3.3	3.4
26	3.4	3.3	3.4	3.8	3.9	3.8	3.6	3.5	3.5	3.45	3.3	3.4
27	3.4	3.3	3.4	3.8	4.1	3.7	3.6	3.5	3.5	3.4	3.3	3.4
28	3.3	3.4	3.4	3.8	4.2	3.7	3.6	3.5	3.5	3.4	3.3	3.4
29	3.3	.....	3.4	3.8	4.5	3.7	3.6	3.5	3.5	3.4	3.3	3.4
30	3.3	.....	3.4	3.9	4.5	3.7	3.6	3.5	3.5	3.4	3.3	3.4
31	3.3	.....	3.5	.....	4.5	.....	3.6	3.5	.....	3.4	.....	3.4

NOTE.—Ice does not form in sufficient quantities to interfere with the discharge.

Rating table for Blacksmith Fork near Hyrum, Utah, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.20	18	3.60	75	4.00	163	4.40	273	4.80	402
3.30	29	3.70	94	4.10	189	4.50	304	4.90	.....
3.40	42	3.80	115	4.20	216	4.60	336	.....	.....
3.50	57	3.90	138	4.30	244	4.70	369	.....	.....

NOTE.—The above table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1905-6 and is well defined.

Monthly discharge of Blacksmith Fork near Hyrum, Utah, for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	42	29	34.9	2,150
February	42	29	30.4	1,690
March	57	29	33.3	2,050
April	216	42	108	6,430
May	304	115	191	11,700
June	273	94	167	9,940
July	94	75	78.7	4,840
August	94	57	67.6	4,160
September	75	57	59.4	3,530
October	57	42	53.2	3,270
November	42	29	35.0	2,080
December	42	29	37.8	2,320
The year	304	29	74.7	54,200

BLACKSMITH FORK POWER PLANT RACE, NEAR HYRUM, UTAH.

This station was established May 16, 1904, for the purpose of ascertaining the amount of water diverted around the regular gaging station at the tollgate and thus determining the total flow of the stream at that point. It is located about 600 feet down the canyon road from the tollgate at the mouth of the canyon, about 200 feet below the head of the canal or race, and about 500 feet south of the river station. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 33, where are given also references to publications that contain data for previous years.

Discharge measurements of Blacksmith Fork power plant race near Hyrum, Utah, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 18	W. G. Swendsen	12.5	25.8	4.72	76
May 5	H. S. Kleinschmidt	13.4	28.5	4.90	88
June 21	Thos. Grieve, jr	14.0	26.2	4.95	91

Daily gage height, in feet, of Blacksmith Fork power plant race near Hyrum, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.7	4.7	4.8	4.0	4.9	4.9	4.5	4.9	4.9	4.8	4.7	4.7
2	4.7	4.7	4.7	4.0	4.9	4.9	4.5	4.9	4.9	4.8	4.7	4.7
3	4.7	4.8	4.7	4.0	4.9	4.9	4.5	4.9	4.9	4.8	4.7	4.6
4	4.7	4.8	4.7	4.0	4.9	4.5	4.5	4.9	4.9	4.8	4.7	4.6
5	4.9	4.7	4.7	4.0	4.9	5.1	4.5	4.9	4.9	4.8	4.7	4.6
6	4.8	4.7	4.7	4.9	4.9	5.1	4.5	4.9	4.9	4.8	4.7	4.6
7	4.7	4.7	4.7	4.0	4.9	5.1	4.5	4.9	4.9	4.8	4.7	4.6
8	4.7	4.7	4.7	4.8	4.9	4.9	4.5	4.9	4.9	4.8	4.7	4.6
9	4.7	4.7	4.7	4.8	4.5	4.9	4.9	4.9	4.9	4.8	4.7	4.6
10	4.6	4.7	4.7	4.8	4.5	4.9	4.9	4.9	4.9	4.8	4.7	4.6
11	4.8	4.7	4.75	4.8	4.5	4.9	4.9	4.9	4.9	4.8	4.7	4.7
12	4.8	4.7	4.75	4.8	4.9	4.9	4.9	4.9	4.9	4.8	4.7	4.7
13	4.8	4.7	4.7	4.8	4.9	4.9	4.9	4.9	4.9	4.8	4.7	4.7
14	4.8	4.7	4.7	4.1	4.9	4.9	4.9	4.9	4.8	4.8	4.7	4.7
15	4.9	4.7	4.7	4.1	4.9	4.9	4.9	4.9	4.8	4.8	4.6	4.7
16	4.9	4.7	4.7	4.1	4.9	4.9	4.9	4.9	4.8	4.8	4.6	4.7
17	4.8	4.7	4.7	4.1	4.9	4.9	4.9	4.9	4.8	4.8	4.6	4.7
18	4.9	4.7	4.7	4.1	4.9	4.9	4.9	4.9	4.8	4.8	4.6	4.7
19	4.9	4.7	4.7	4.1	4.5	4.9	4.9	4.9	4.8	4.8	4.6	4.7
20	4.9	4.7	4.7	4.1	4.9	4.9	4.9	4.9	4.8	4.8	4.6	4.7
21	4.7	4.7	4.7	4.9	4.8	4.9	4.9	4.9	4.8	4.8	4.7	4.7
22	4.8	4.7	4.7	4.9	4.8	4.9	4.9	4.9	4.8	4.8	4.7	4.7
23	4.7	4.7	4.7	4.9	4.8	4.9	4.9	4.9	4.8	4.8	4.7	4.7
24	4.7	4.7	4.7	4.9	4.8	4.5	4.9	4.9	4.8	4.8	4.7	4.7
25	4.7	4.7	4.9	4.9	4.8	4.5	4.9	4.9	4.8	4.8	4.7	4.7
26	4.8	4.7	4.9	4.9	4.8	4.5	4.9	4.9	4.8	4.8	4.7	4.7
27	4.8	4.7	4.9	4.9	4.9	4.5	4.9	4.9	4.8	4.8	4.7	4.6
28	4.7	4.8	4.9	4.9	4.9	4.5	4.9	4.9	4.8	4.8	4.7	4.6
29	4.7	.....	4.9	4.9	4.9	4.5	4.9	4.9	4.8	4.8	4.7	4.6
30	4.7	.....	5.0	4.9	4.9	4.5	4.9	4.9	4.8	4.8	4.7	4.6
31	4.7	.....	5.0	.....	4.9	.....	4.9	4.9	.....	4.8	.....	4.6

NOTE.—Little or no ice forms in the stream.

Rating table for Blacksmith Fork power-plant race near Hyrum, Utah, for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.00	25	4.30	44	4.60	66	4.90	88
4.10	31	4.40	51	4.70	73	5.00	96
4.20	37	4.50	58	4.80	80	5.10	104

NOTE.—The above table is applicable only for open-channel conditions. It is based upon 11 discharge measurements made during 1904–1906 and is fairly well defined.

Monthly discharge of Blacksmith Fork power-plant race near Hyrum, Utah, for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	88	66	77.7	4,780
February	80	73	73.8	4,100
March	96	73	77.3	4,750
April	88	25	60.5	3,600
May	88	58	82.6	5,080
June	104	58	81.6	4,860
July	88	58	80.3	4,940
August	88	88	88.0	5,410
September	88	80	83.5	4,970
October	80	80	80.0	4,920
November	73	66	71.6	4,260
December	73	66	70.1	4,310
The year	104	25	77.2	56,000

WEBER RIVER BASIN.

DESCRIPTION OF BASIN.

Weber River rises on the northern slope of the Uinta Mountains and flows in a tortuous course northwestward into Great Salt Lake.

The upper portion of the basin is very rough. The highest peaks, reaching an elevation of about 13,000 feet, are masses of sandstone and quartzite, entirely barren of vegetation and covered with snow for almost the entire year. Farther down the prevailing formation is limestone, overlain with sandstone and conglomerate. A thin layer of soil covers the basin in patches and supports small groves of fir and aspen. There are no extensive forests, meadows, or marshes. The greater part of the precipitation is in the form of snow, the melting of which is the chief source of the spring flood and early summer flow. A large part of the normal flow is derived from springs, which are well distributed over the area. Numerous tributaries, all short and confined to steep, narrow canyons, enter all along the course.

Between Oakley and Croyden the river traverses a very narrow valley comprising irrigated farms. The principal formation over this area is of conglomerate and sandstone, with but little loose and porous overlying soil except near the stream bed, where the deposit of bowlders and soil ranges from 10 to 20 feet in depth. The chief tributaries in this stretch of the river are Beaver Creek, which enters from the south about 6 miles below Oakley and drains a rough country about 71 square miles in extent; Chalk Creek, from the east, which drains a rough, dry country, about 248 square miles in area, and enters the Weber 15 miles above Croyden; and Lost Creek, which comes in from the east at a point about one-half mile above the Devils Slide gaging station and has a watershed of 205 square miles. Gaging stations are maintained near the mouth of Chalk and Lost creeks.

Between Croyden and Plain City the stream flows in a well-defined channel through a comparatively narrow, steep canyon, with occasional stretches of narrow valley containing irrigated farming lands. The rock is a porous and badly fissured sandstone and conglomerate, with but little overlying soil. Near the mouth of the canyon the material is a very rough but compact limestone. East Creek, which enters near Morgan, discharges but little water into the river, as its flow is completely controlled by a storage reservoir about 5 miles above its mouth, the water being used for irrigation in the Morgan Valley, through which the Weber flows. After leaving the Wasatch Range the Weber enters the Great Salt Lake Valley, through which it flows in a well-defined channel with no overflow.

Ogden River joins the Weber about 8 miles above Plain City. It drains a rough and rugged limestone area, 363 square miles in extent,

in the western slopes of the Wasatch Range. The main stream and its numerous short tributaries are confined to steep, narrow canyons. The entire normal flow of the stream is diverted for irrigation near the foot of the canyon about 3 miles above the mouth of the river, after being used for the development of power by the Utah Light and Railway Company. The flood and winter flow, therefore, is all that reaches the Weber, except for a small amount of seepage from the irrigated district. The city of Ogden also derives its water supply from Ogden River.

There are at present no storage reservoirs on the Weber, but a number of possibilities exist.

WEBER RIVER NEAR OAKLEY, UTAH.

This station was established October 22, 1904. It is located approximately 200 feet south of the main canyon road, about 3 miles above Oakley, Utah, and is above all diversions to the Kamas prairie region. The object of the station is to determine the amount of water available for diversion through the low Kamas Pass into Provo River, which is a part of the reclamation scheme in the development of the Weber River project. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 36, where are given also references to publications that contain data for previous years.

Discharge measurements of Weber River near Oakley, Utah, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 9	W. G. Swendsen	48.5	38.6	5.10	[a] 71.9
May 31	H. S. Kleinschmidt	51	146	5.95	768
August 11	Thos. Grieve, jr	46	74	4.50	127

[a] Ice 1.55 feet thick, gage height to top of ice 5.50 feet.

Daily gage height, in feet, of Weber River near Oakley, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1				4.2	4.85	5.9	5.95	4.6	4.7	4.25	4.2	4.6
2				4.2	4.9	6.1	5.9	4.65	4.7	4.25	4.2	4.5
3	5.25	4.5	4.05	4.2	5.0	6.1	5.9	4.65	4.65	4.25	4.2	4.45
4				4.2	5.2	6.2	5.8	4.6	4.6	4.25	4.2	
5				4.15	5.4	6.4	5.85	4.6	4.6	4.25	4.2	4.4
6	4.8			4.2	5.5	6.5	5.85	4.55	4.5	4.25	4.2	
7				4.2	5.6	6.2	5.7	4.5	4.5	4.25	4.2	
8				4.25	5.7	6.0	5.7	4.5	4.45	4.25	4.2	4.15
9				4.3	5.9	6.05	5.6	4.5	4.45	4.25	4.2	
10	5.1	5.1	4.1	4.4	6.0	6.2	5.55	4.5	4.4	4.25	4.15	
11				4.5	6.2	6.8	5.55	4.45	4.4	4.2	4.15	
12				4.45	6.4	7.3	5.4	4.45	4.4	4.2	4.15	4.15
13				4.45	6.1	8.0	5.45	4.7	4.4	4.2	4.15	
14				4.5	6.0		5.35	4.55	4.4	4.2	4.15	
15				4.55	5.9	7.2	5.3	4.4	4.4	4.2	4.15	4.05
16	4.7			4.6	5.7	7.7	5.3	4.4	4.4	4.2	4.15	
17		4.1		4.7	5.6	6.9	5.25	4.4	4.4	4.2	4.15	
18			4.0	4.8	5.6	6.7	5.25	4.4	4.4	4.2	4.1	
19				4.85	5.9	6.7	5.2	4.4	4.4	4.2	4.1	4.2
20				4.9	6.2	6.4	5.2	4.9	4.4	4.15	4.15	
21				5.0	6.4	6.5	5.15	4.9	4.4	4.15	4.2	
22				5.2	6.5	6.4	5.1	5.1	4.4	4.15	4.25	4.15
23				5.55	6.5	6.3	5.0	4.9	4.35	4.15	4.25	
24		4.05	4.25	5.5	6.6	6.2	4.95	4.7	4.35	4.15	4.3	
25				5.2	6.2	5.8	4.8	4.6	4.35	4.2	4.3	
26				5.0	6.1	5.9	4.8	4.6	4.35	4.2		4.15
27	4.65			4.7	6.2	5.9	4.75	4.6	4.25	4.2	4.4	
28				4.7	6.7	6.05	4.7	4.55	4.25	4.2	4.3	
29				4.8	6.3	5.9	4.65	4.55	4.25	4.2	4.5	4.15
30				4.8	6.2	5.85	4.6	4.4	4.25	4.2	4.6	
31			4.2		6.0		4.6	4.4		4.2		

NOTE.—Ice conditions, January 1 to March 30, with average ice thickness of about 1.0 foot; November 19 to December 2, with a maximum thickness of 1.0 foot; and December 15 to 25. River free of ice December 3 to 14, and December 26 to 31.

Rating table for Weber River near Oakley, Utah, for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.00	46	4.80	209	5.50	490	6.20	917	6.90	1,490
4.10	58	4.90	241	5.60	542	6.30	990	7.00	1,580
4.20	73	5.00	275	5.70	597	6.40	1,066	7.20	1,760
4.30	90	5.10	312	5.80	655	6.50	1,145	7.40	1,940
4.40	109	5.20	352	5.90	716	6.60	1,227	7.60	2,120
4.50	130	5.30	395	6.00	780	6.70	1,312	7.80	2,300
4.60	154	5.40	441	6.10	847	6.80	1,400	8.00	2,480
4.70	180								

NOTE.—The above table is applicable only for open-channel conditions. It is based upon 10 discharge measurements made during 1904–6 and is well defined between gage heights 4.0 and 6.0 feet.

Monthly discharge of Weber River near Oakley, Utah, for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
April	516	66	182	10,800
May	1,310	225	760	46,700
June	2,480	655	1,150	68,400
July	748	154	419	25,800
August	312	109	153	9,410
September	180	82	116	6,900
October	82	66	74.8	4,600
November 1–19	73	58	68.5	2,580
The period				175,000

WEBER RIVER NEAR CROYDEN, UTAH.

This station was established February 1, 1905. It is located about 1½ miles west of the town of Croyden, one-fourth mile below the junction of Lost Creek and Weber River, about three-fourths mile up the river from Croyden station on the Union Pacific Railroad, and 10 miles down the river from the town of Echo, just below the narrow canyon at the lower end of Henefer Valley.

The station is important as showing the amount of water available for storage in the Henefer basin, about 2 miles above the station, the development of which is a part of the reclamation scheme on the Weber River project. The winter records will be of special value, since the entire winter flow of the stream is at present discharged as waste into Great Salt Lake. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 38, where are given also references to publications that contain data for previous years.

Discharge measurements of Weber River near Croydon, Utah, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 8	W. G. Swendsen	91	87.1	1.75	154
April 29	H. S. Kleinschmidt	93	157	2.48	515
May 12	do	106	355	4.40	2,080
June 15	Thos. Grieve, jr.	110	439	4.90	2,640
August 9	do	91	85.5	1.64	152

Daily gage height, in feet, of Weber River near Croydon, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.6	1.8	1.9	3.2	2.87	4.22	3.0	1.72	2.15	1.8	1.82	1.74
2	1.6	1.75	1.8	2.6	2.86	4.0	3.2	1.85	2.35	1.89	1.9	1.72
3	1.65	1.7	1.8	2.5	2.89	4.1	3.3	1.83	2.4	1.8	1.87	1.8
4	1.7	1.8	1.85	2.2	3.15	4.1	3.1	1.82	2.2	1.68	1.86	1.85
5	1.7	1.75	1.85	2.25	3.6	4.3	2.9	1.84	2.15	1.79	1.83	1.9
6	1.6	1.7	1.8	2.35	3.64	5.0	2.8	1.81	2.1	1.8	1.85	1.91
7	1.7	1.7	1.85	2.5	3.66	4.9	2.75	1.7	2.05	1.78	1.87	1.92
8	1.7	1.6	1.85	2.98	3.68	4.35	2.7	1.71	2.0	1.79	1.9	1.9
9	1.78	1.65	1.9	3.1	3.8	4.15	2.68	1.7	2.0	1.68	1.87	1.89
10	1.6	1.65	1.95	2.85	3.9	4.3	2.65	1.67	2.0	1.75	1.86	1.9
11	1.6	1.7	1.9	2.95	4.1	4.4	2.5	1.66	2.0	1.76	1.85	2.04
12	1.6	1.75	1.9	2.9	4.1	4.8	2.45	1.65	2.0	1.75	1.82	2.2
13	1.6	1.75	2.2	2.65	4.09	5.3	2.4	1.67	1.95	1.75	1.83	2.02
14	1.65	1.8	2.1	2.6	4.1	5.4	2.4	1.65	2.0	1.76	1.82	1.9
15	1.7	1.9	2.1	2.65	4.0	5.0	2.4	1.65	1.93	1.78	1.84	1.73
16	1.7	2.0	1.9	2.7	3.8	4.45	2.35	1.67	2.0	1.77	1.84	1.7
17	1.7	1.85	1.85	2.85	3.7	4.5	2.3	1.67	2.0	1.76	1.85	1.78
18	1.75	1.85	1.85	3.1	3.55	4.45	2.2	1.67	2.0	1.75	1.8	1.8
19	2.1	1.85	1.85	3.05	3.6	4.0	2.15	1.75	1.98	1.76	1.73	1.89
20	2.0	1.8	1.8	3.05	3.9	3.9	2.1	2.0	1.9	1.77	1.74	1.9
21	2.0	1.85	1.9	3.15	4.0	3.75	2.0	2.5	1.98	1.76	1.78	1.8
22	1.9	1.8	2.0	3.35	4.2	3.7	1.95	2.65	1.98	1.75	1.9	1.75
23	1.8	1.8	2.2	3.5	4.15	3.68	1.9	2.67	1.89	1.73	1.74	1.85
24	1.8	1.8	2.45	3.55	4.1	3.5	1.9	2.4	1.87	1.75	1.79	1.87
25	1.85	1.85	3.1	3.35	4.3	3.0	1.89	2.3	1.89	1.8	1.8	1.88
26	1.8	1.85	3.2	3.2	3.8	3.0	1.87	2.25	1.8	1.8	1.89	1.89
27	1.8	1.8	3.0	3.15	4.4	3.1	1.85	2.2	1.8	1.79	1.85	2.1
28	1.8	1.9	2.65	3.0	4.8	3.15	1.79	2.15	1.8	1.8	1.87	2.05
29	1.8	.....	2.62	2.9	5.2	3.5	1.68	2.1	1.79	1.78	1.86	2.0
30	1.75	.....	2.75	2.85	4.8	3.1	1.69	2.05	1.78	1.79	1.79	1.9
31	1.8	.....	2.6	.....	4.55	.....	1.7	2.1	.....	1.78	.....	1.89

NOTE.—Flow during the winter period was probably not greatly affected by ice conditions.

Rating tables for Weber River, near Croydon, Utah.

FEBRUARY 1, 1905, TO MARCH 31, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.40	50	1.80	160	2.20	319	2.60	541	3.00	820
1.50	73	1.90	195	2.30	368	2.70	605	3.10	900
1.60	99	2.00	233	2.40	422	2.80	673	3.20	985
1.70	128	2.10	274	2.50	480	2.90	745	3.30	1,070

APRIL 1, 1906, TO DECEMBER 31, 1906.[b]

1.50	110	2.20	368	2.90	782	3.60	1,348	4.60	2,318
1.60	138	2.30	418	3.00	856	3.70	1,438	4.80	2,524
1.70	166	2.40	472	3.10	930	3.80	1,528	5.00	2,732
1.80	202	2.50	526	3.20	1,008	3.90	1,620	5.20	2,940
1.90	240	2.60	584	3.30	1,090	4.00	1,716	5.40	3,152
2.00	280	2.70	646	3.40	1,174	4.20	1,916		
2.10	322	2.80	712	3.50	1,260	4.40	2,116		

[a] This table is applicable only for open-channel conditions. It is based upon 8 discharge measurements made during 1905 and first quarter of 1906, and is well defined.

[b] This table is applicable only for open-channel conditions. It is based upon 4 discharge measurements made during 1906 and the form of the previous curve, and is well defined.

Monthly discharge of Weber River near Croydon, Utah, for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	274	99	145	8,920
February	233	99	157	8,720
March	985	160	327	20,100
April	1,300	368	802	47,700
May	2,940	754	1,660	102,000
June	3,150	856	1,850	110,000
July	1,090	160	474	29,100
August	627	152	268	16,500
September	472	195	280	16,700
October	236	177	192	11,800
November	240	177	215	12,800
December	368	166	236	14,500
The year	3,150	99	550	399,000

WEBER RIVER NEAR PLAIN CITY, UTAH.

This station was established in 1903 under the direction of the State engineer of Utah, and was maintained under his direction until May 14, 1905, when it was taken up by the United States Geological Survey with the stipulation that the expense of daily gage readings should be defrayed by the State. It is located at the Plain City and West Weber highway bridge, about 10 miles west of Ogden, on the main road leading to Plain City and West Weber, below all points of diversion from and inflow to the stream.

The station is important as showing the amount of water discharged by the stream into Great Salt Lake, information necessary to the adjudication of water rights on the Ogden and Weber rivers. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, p. 41.

Discharge measurements of Weber River near Plain City, Utah, for 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
March 28	W. G. Swendsen	124	824	10.2	2,040
May 14	H. S. Kleinschmidt	139	1,280	13.8	3,510
June 1	do	131	1,640	16.3	4,630
June 14	Thos. Grieve, jr.	133	1,460	14.9	4,090
June 27	do	115	432	6.9	729
July 16	do	93	151	4.0	139
August 11	do	36	14.8	2.6	10.5

Daily gage height, in feet, of Weber River near Plain City, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	5.0	5.6	10.2	10.1	16.3	7.8	2.8	5.3	4.3	5.1	5.5
2	.....	5.0	5.4	9.8	9.9	16.8	7.5	2.7	5.7	4.2	5.2	5.5
3	4.6	4.9	5.3	9.0	9.8	16.0	7.3	2.7	6.0	4.1	5.2	5.5
4	.....	4.9	5.3	8.0	10.3	15.6	6.8	2.7	5.5	4.1	5.2	5.5
5	.....	4.8	5.4	8.2	12.7	15.2	6.4	2.7	5.2	4.1	5.2	5.5
6	4.2	4.7	5.5	8.2	12.2	15.0	5.9	2.6	5.1	4.1	5.2	5.5
7	.....	4.7	5.4	8.3	12.4	16.0	5.6	2.6	4.9	4.2	5.1	5.5
8	.....	4.8	5.3	9.2	12.4	15.8	5.3	2.6	4.8	4.2	5.1	5.5
9	.....	4.9	5.3	9.9	12.8	15.5	5.2	2.6	4.7	4.3	5.1	5.6
10	4.3	5.0	5.5	10.6	13.0	14.7	5.1	2.6	4.5	4.3	5.1	5.6
11	.....	4.9	5.7	10.2	13.2	14.0	4.9	2.6	4.4	4.3	5.1	5.4
12	.....	4.8	6.3	9.8	13.8	14.2	4.8	2.6	4.4	4.3	5.0	5.3
13	4.9	4.8	7.4	9.1	14.4	14.4	4.5	2.6	4.3	4.3	5.0	5.2
14	.....	4.9	6.8	9.1	13.6	14.7	4.2	2.6	4.3	4.2	5.0	5.1
15	.....	5.1	6.3	9.2	12.5	14.6	4.0	2.6	4.4	4.2	5.0	5.0
16	.....	5.3	6.1	9.8	12.2	13.8	3.9	2.6	4.5	4.3	5.0	5.0
17	5.2	5.3	5.8	10.9	11.4	13.1	3.5	2.6	4.6	4.3	5.1	5.1
18	.....	5.3	5.8	11.8	10.6	12.5	3.3	2.6	4.6	4.4	5.1	5.2
19	.....	5.3	5.8	12.1	10.8	10.9	3.1	2.6	4.6	4.5	5.2	5.2
20	7.4	5.4	5.9	11.6	11.0	10.4	3.0	3.2	4.6	4.6	5.2	5.2
21	.....	5.5	6.0	11.9	11.6	9.7	2.9	6.7	4.6	4.7	5.3	5.3
22	.....	5.5	6.0	12.4	11.8	9.3	2.9	8.5	4.6	4.7	5.3	5.3
23	.....	5.4	7.3	13.1	11.6	8.9	2.9	8.0	4.6	4.8	5.3	5.3
24	5.3	5.3	7.5	13.4	11.4	8.5	2.9	7.3	4.6	4.8	5.3	5.3
25	.....	5.3	10.7	12.5	11.3	8.3	2.8	6.2	4.6	4.8	5.3	5.3
26	.....	5.3	11.5	11.9	12.0	8.1	2.8	6.1	4.5	4.9	5.3	5.9
27	5.1	5.4	11.1	10.7	12.7	8.0	2.8	5.9	4.5	4.9	5.4	7.5
28	.....	5.4	10.3	10.2	14.7	8.3	2.9	5.9	4.4	5.0	5.4	6.9
29	.....	.....	9.3	10.0	16.0	8.1	2.9	5.8	4.4	5.0	5.4	6.1
30	.....	.....	9.2	10.0	16.0	7.8	2.8	5.7	4.3	5.0	5.5	5.7
31	5.4	.....	9.4	.....	17.3	.....	2.8	5.5	.....	5.1	.....	5.6

NOTE.—Ice conditions January 1 to 30. Gage readings during the frozen period were taken to the surface of the water.

Rating table for Weber River near Plain City, Utah, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.60	10	3.50	70	4.40	185	5.60	395	7.40	905
2.70	14	3.60	80	4.50	200	5.80	440	7.60	975
2.80	18	3.70	90	4.60	215	6.00	490	7.80	1,045
2.90	23	3.80	102	4.70	230	6.20	540	8.00	1,115
3.00	28	3.90	114	4.80	245	6.40	595	9.00	1,500
3.10	34	4.00	128	4.90	260	6.60	655	10.00	1,895
3.20	40	4.10	142	5.00	275	6.80	715	11.00	2,310
3.30	50	4.20	156	5.20	315	7.00	775	12.00	2,740
3.40	60	4.30	170	5.40	355	7.20	835	13.00	3,180

NOTE.—The above table is applicable only for open-channel conditions. It is based upon 7 discharge measurements made during 1906, and is well defined.

Monthly discharge of Weber River near Plain City, Utah, for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
February	375	230	299	16,600
March	2,520	335	830	51,000
April	3,360	1,120	2,060	123,000
May	5,150	1,810	2,940	181,000
June	4,920	1,040	3,000	179,000
July	1,040	18	241	14,800
August	1,300	10	240	14,800
September	490	170	238	14,200
October	295	142	199	12,200
November	375	275	313	18,600
December	940	275	388	23,900
The period				649,000

PROVO RIVER BASIN.

DESCRIPTION OF BASIN.

Provo River has its source in the Uinta Mountains and flows westward in a steep, narrow canyon until it reaches Heber or Provo Valley, through which it winds in a well-defined channel. Leaving the valley, it flows southwestward, cutting through the Wasatch Range in another steep, narrow, and extremely rough canyon, and finally discharging its surplus waters into Utah Lake.

In the mountain regions the principal rock is a compact limestone. Except in Heber Valley there is but little soil in any portion of the basin. Small groves of fir and aspen are, however, scattered over almost the entire area, and there is a light growth of underbrush. There are no extensive forests, meadows, or marshes. In the canyons the stream receives numerous short and swift tributaries, deriving their principal supply from springs, but a part also from the melting of the snow, which covers portions of the high mountains during the entire year. The highest peaks reach elevations of about 13,000 feet.

Heber Valley, which comprises an area of about 20 square miles, is an irrigated farming district, composed of a deposit of loose bowlders, gravel, and soil, very porous. Most of the water comes from the main stream, though a part is received from small creeks which enter the valley from the south. The most important of these is Daniels Creek, into which some water is diverted from Strawberry River, a tributary of Green River, by three small canals in low passes at the head of the creek.

There are a few lakes at the head of the river, but they are so small that they probably have little effect in regulating the flow. There is no storage on the stream at present, but a few possibilities exist which will doubtless be developed in the future, as the entire stream, after being used at the mouth of the canyon for the development of power, is now utilized on lands in the vicinity of Utah Lake, and the supply is altogether insufficient.

PROVO RIVER ABOVE TELLURIDE POWER COMPANY'S DAM, NEAR PROVO, UTAH.

This station was established March 1, 1905. It is located about three-fourths of a mile up the river from Upper Falls, a station on the Provo Canyon branch of the Rio Grande Western Railway, about 4 miles above the mouth of the canyon and 800 feet south of the canyon road, in J. W. Slick's pasture. It is about one-half mile above the Telluride Power Company's dam and above all diversions into Utah Lake Valley. The object of the station is the collection of data concerning the amount of water passing from the river into this valley. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 50.

Discharge measurements of Provo River above Telluride Power Company's dam, near Provo, Utah, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
February 14	W. G. Swendsen	69	113	3.80	222
May 10	H. S. Kleinschmidt	76	222	5.30	886
June 3	Thos. Grieve, jr.	80	244	5.40	993
June 13	do	96	396	7.00	1,762
July 7	do	71	156	4.20	402

Daily gage height, in feet, of Provo River above Telluride Company's dam, near Provo, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug	Sept.	Oct.	Nov.	Dec.
1	3.8	3.8	4.0	4.65	4.5	6.2	4.45	3.85	4.0	3.9	4.1	3.8
2	4.0	3.8	3.9	4.4	4.5	5.7	4.45	3.9	4.05	3.9	4.05	3.8
3	4.1	3.7	3.9	4.55	4.5	5.35	4.45	3.9	4.05	3.8	4.05	3.8
4	3.8	3.7	3.95	4.1	4.6	5.4	4.45	3.95	4.05	3.8	4.0	4.1
5	3.85	3.7	3.85	4.1	4.8	5.4	4.4	3.9	4.05	3.8	4.0	4.15
6	3.9	3.65	3.8	4.1	5.0	5.5	4.4	3.85	4.0	3.9	4.05	4.0
7	3.9	3.5	3.85	4.15	4.1	6.4	4.35	3.8	4.0	3.9	4.0	4.0
8	4.25	3.7	3.85	4.25	4.9	5.7	4.3	3.8	4.0	3.9	4.0	4.0
9	4.25	3.6	3.9	4.35	5.0	5.3	4.15	3.8	4.0	3.9	3.95	4.0
10	5.0	3.7	3.95	4.5	5.3	5.5	4.1	3.8	3.95	3.9	3.95	4.05
11	4.0	3.85	4.0	4.5	5.4	5.35	3.95	3.75	3.95	3.9	3.95	4.1
12	3.75	3.75	4.8	4.5	6.2	6.3	3.9	3.75	3.95	3.9	3.9	4.15
13	3.8	3.75	4.5	4.35	6.3	6.7	3.9	3.75	3.95	3.9	3.9	4.3
14	.....	3.8	4.2	4.3	5.7	7.1	3.95	3.7	4.0	3.9	3.95	4.1
15	4.1	3.9	4.1	4.4	5.4	6.7	4.0	3.7	4.0	3.9	3.95	3.9
16	3.95	4.0	3.8	4.45	5.3	6.5	3.95	3.7	4.0	3.85	3.95	3.9
17	4.0	3.9	3.9	4.6	5.2	6.5	3.95	3.7	4.0	3.85	4.0	4.0
18	3.95	3.9	3.95	4.8	5.0	6.0	3.9	3.7	4.0	3.8	4.0	4.0
19	4.6	4.1	3.8	4.8	5.1	5.8	3.9	3.75	4.0	3.8	3.8	4.0
20	4.6	4.0	3.9	4.75	5.6	5.6	3.9	4.08	4.0	3.8	3.7	4.0
21	4.5	4.0	3.95	4.8	5.8	5.4	3.9	3.95	3.95	3.8	3.9	3.9
22	3.75	4.0	4.1	4.9	6.0	5.3	3.9	4.15	3.9	3.8	3.9	3.9
23	3.9	3.9	4.2	5.1	6.1	5.2	4.0	4.0	3.95	3.8	4.0	3.9
24	3.95	3.9	4.55	5.0	6.1	5.2	4.0	3.95	3.9	3.8	4.0	4.0
25	3.9	3.9	4.85	4.9	6.1	5.3	3.95	3.9	3.9	3.8	4.0	4.0
26	3.8	3.9	4.5	4.8	6.8	5.4	3.95	3.95	3.85	3.8	4.0	4.4
27	3.8	3.85	4.4	4.7	6.3	5.8	3.95	3.9	3.9	3.85	3.9	4.45
28	3.8	3.95	4.4	4.6	6.2	5.6	3.9	3.9	3.9	3.85	3.9	4.2
29	3.8	.....	4.3	4.6	6.4	4.65	3.9	3.95	3.9	3.9	3.9	4.1
30	3.7	.....	4.4	4.55	6.2	4.5	3.8	3.9	3.9	3.9	3.8	4.0
31	3.65	.....	4.5	.....	5.7	.....	3.8	3.95	.....	3.9	.....	4.05

NOTE.—Ice conditions January 1-15. River assumed to be clear of ice after January 15.

Rating table for Provo River above Telluride Power Company's dam, near Provo, Utah, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.50	100	4.30	442	5.10	814	5.80	1,146	6.50	1,480
3.60	142	4.40	486	5.20	862	5.90	1,194	6.60	1,526
3.70	184	4.50	530	5.30	912	6.00	1,242	6.70	1,576
2.80	226	4.60	576	5.40	958	6.10	1,288	6.80	1,626
3.90	268	4.70	622	5.50	1,004	6.20	1,336	6.90	1,776
4.00	310	4.80	670	5.60	1,050	6.30	1,384	7.00	1,826
4.10	354	4.90	718	5.70	1,098	6.40	1,432	7.10	1,876
4.20	398	5.00	766						

NOTE.—The above table is applicable only for open-channel conditions. It is based upon 5 discharge measurements made during 1906 and is fairly well defined.

Monthly discharge of Provo River above Telluride Power Company's dam, near Provo, Utah, for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January 16–31	576	163	303	9,620
February	354	100	238	13,200
March	694	226	370	22,800
April	814	354	556	33,100
May	1,630	354	999	61,400
June	1,880	530	1,110	66,000
July	508	226	337	20,700
August	376	184	251	15,400
September	332	247	297	17,700
October	268	226	249	15,300
November	354	184	290	17,300
December	508	226	327	20,100
The period				313,000

PROVO RIVER AT MOUTH OF CANYON, NEAR PROVO, UTAH.

This station was established July 27, 1889, and was discontinued June 30, 1906. It was located about 6 miles north of Provo, about 1,000 feet above Olmstead station, on the Provo Canyon branch of the Rio Grande Western Railway, and 1,200 feet above the power house of the Telluride Power Company. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 53, where are given also references to publications that contain data for previous years.

Daily gage height, in feet, of Provo River at mouth of canyon, near Provo, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Day.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	3.35	3.60	4.05	4.90	4.95	.....	17	3.91	3.95	4.05	4.92	5.52	6.15
2	3.80	3.68	3.90	4.70	4.80	.....	18	4.05	3.90	4.05	5.15	5.40	5.95
3	3.62	3.60	3.85	4.55	4.82	.....	19	5.15	4.12	3.95	5.12	5.50	5.92
4	3.71	3.52	3.88	4.45	5.00	5.80	20	4.90	4.08	4.10	5.10	5.92	5.90
5	3.66	3.55	3.82	4.28	5.18	6.02	21	4.38	4.20	4.02	5.25	6.10	5.75
6	3.61	3.56	3.85	4.28	5.32	6.50	22	4.00	4.08	4.25	5.40	6.20	5.68
7	3.31	3.55	3.80	4.35	5.32	6.12	23	3.92	3.95	4.60	5.40	6.25	5.55
8	3.60	3.55	3.95	4.42	5.40	5.80	24	4.04	3.88	4.95	5.40	6.30	5.50
9	3.46	3.54	4.02	4.65	5.42	5.68	25	3.95	4.00	5.28	5.30	6.32	5.25
10	3.65	3.70	4.15	4.85	5.65	5.90	26	3.91	3.92	5.50	5.20	6.08	5.05
11	3.65	3.55	4.05	4.90	5.82	6.15	27	3.91	3.90	4.90	5.00	6.42	5.10
12	3.70	3.61	5.15	4.82	6.25	6.50	28	3.75	3.98	4.82	4.95	6.58	5.18
13	3.78	3.50	4.68	4.70	6.50	7.02	29	3.55	.....	4.70	4.95	6.60	5.10
14	4.00	3.70	4.40	4.55	5.90	6.78	30	3.62	.....	4.65	4.90	6.18	5.08
15	3.99	3.95	4.22	4.60	5.72	6.45	31	3.69	.....	4.45	.....	5.92	.....
16	4.12	4.05	4.08	4.80	5.55	6.15							

NOTE.—Slight ice conditions during January.

HOBBLE CREEK BASIN.

HOBBLE CREEK, NEAR SPRINGVILLE, UTAH.

Hobble Creek rises on the western slope of the Wasatch Mountains and flows in a general southwesterly direction to Utah Lake. There is little overlying soil and but a scanty growth of timber or brush. The steep, narrow canyon in which the stream flows is broken here and there by narrow openings or flats, covered with a shallow deposit of bowlders and soil and comprising irrigated farms. As these tracts lie along the banks of the creek, a large part of the water used on them is returned to the stream as seepage. There are no tributaries of importance, but short, intermittent streams, each of which is confined to a steep, narrow canyon, enter all along the course. There are no storage reservoirs, lakes, or marshes to control the flood discharge, which occurs in the spring as the result of melting snow. The entire normal summer flow is used for irrigation, but the diversion takes place for the most part at the mouth of the canyon below the gaging station.

The station was established March 23, 1904. It is located about 1 mile above the mouth of the canyon, 4 miles southeast of Springville, Utah, 600 feet northeast of the head of Mapleton Canal, and about 1,200 feet southwest of the Springville electric power plant. The conditions and the bench marks are described in Water-Supply Paper No. 176, page 58, where are given also references to publications that contain data for previous years.

Discharge measurements of Hobble Creek near Springville, Utah, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 3	Thos. Grieve, jr	18.5	17.8	1.95	66.1
August 7	do	17.5	16.1	1.55	19.2

Daily gage height, in feet, of Hobble Creek near Springville, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	1.25	.....	1.7	2.5	2.5	1.85	1.65	1.55	1.5	1.55	.....
2	1.25	.....	.....	1.7	2.5	2.45	1.85	1.6	1.6	1.5	1.55	.....
3	.....	1.2	.....	1.6	2.7	2.4	1.9	1.6	1.6	1.5	1.5	1.5
4	.....	.....	.....	1.55	3.3	2.35	1.9	1.6	1.55	1.55	.....	.....
5	.....	1.2	1.35	1.55	3.8	2.35	1.85	.....	1.55	1.55	1.5	1.5
6	.....	.....	.....	1.6	4.0	2.45	1.85	1.55	1.55	1.55	1.45	.....
7	1.25	1.2	1.25	1.7	3.7	.....	1.85	1.5	1.55	1.5	1.5	1.55
8	.....	.....	.....	1.88	3.7	2.3	1.85	1.55	1.55	1.5	.....	.....
9	.....	1.2	1.25	2.1	3.8	2.25	1.85	1.55	.....	1.45	.....	.....
10	1.25	.....	1.3	2.35	3.9	2.25	1.8	1.55	1.55	1.4	.....	.....
11	.....	.....	1.3	2.5	3.9	.....	1.8	1.55	1.55	1.45	1.5	1.55
12	1.25	.....	1.35	2.35	.....	2.2	1.75	.....	.....	1.45	1.5	.....
13	.....	1.2	.....	2.45	4.0	2.2	1.75	1.5	1.55	1.5	1.5	.....
14	.....	.....	1.35	2.4	3.4	2.2	1.75	1.55	1.55	.....	1.5	.....
15	.....	.....	.....	2.6	3.4	2.15	1.75	1.55	1.55	1.5	1.5	1.5
16	1.3	.....	.....	2.62	3.3	2.15	1.75	1.5	.....	1.5	.....	.....
17	.....	1.3	1.3	3.35	3.2	2.15	1.75	1.55	1.6	1.5	1.5	.....
18	.....	1.3	.....	4.0	3.1	2.15	1.75	1.55	1.55	1.55	.....	1.55
19	1.35	1.3	1.3	3.9	3.2	2.1	1.75	.....	1.5	1.55	1.45	.....
20	.....	1.25	1.3	3.6	.....	2.0	1.75	1.7	1.5	.....	1.45	.....
21	1.3	.....	1.35	3.85	3.2	.....	1.7	1.7	1.55	.....	1.5	1.55
22	.....	.....	1.35	.....	3.0	1.95	1.6	1.65	1.55	1.5	.....	.....
23	1.3	1.3	1.35	3.9	3.0	.....	1.6	1.6	1.55	1.5	.....	.....
24	.....	1.3	1.4	3.3	2.9	.....	1.6	1.6	1.55	1.5	1.5	.....
25	1.25	1.3	1.45	3.0	2.7	1.9	1.55	1.55	1.55	1.5	.....	1.55
26	.....	1.25	1.55	2.7	2.7	1.85	1.65	1.55	1.55	1.5	1.5	.....
27	1.2	1.3	1.6	2.5	2.8	1.85	1.65	1.55	1.55	1.5	.....	1.55
28	.....	.....	1.65	2.5	3.0	1.9	1.65	1.5	1.55	.....	.....	.....
29	.....	.....	1.6	.....	2.8	1.8	.....	1.55	1.55	1.5	.....	1.55
30	1.25	.....	1.6	2.45	2.6	.....	1.6	1.57	1.4	1.5	1.5	.....
31	.....	.....	1.65	.....	2.6	.....	1.6	1.55	.....	1.5	.....	.....

SPANISH FORK BASIN.

DESCRIPTION OF BASIN.

Spanish Fork rises in the Wasatch Mountains and flows northwestward into Utah Lake. The area is generally barren, with but little timber or brush. The stream is confined to a steep, narrow canyon, with a very few small openings in which are irrigated farms. The tributaries are all short and many of them are intermittent. The most important are Diamond Fork and Thistle Creek, which enter about 8 and 10 miles, respectively, above the gaging station, and which, like the main stream, occupy steep narrow canyons. The normal flow comes largely from springs, scattered over the entire basin; the flood discharge is direct surface run-off from melting snow.

There are no storage reservoirs on the stream and but little of the flow is diverted above the gaging station at Spanish Fork; the entire normal flow is, however, diverted at the mouth of the canyon, immediately below the station, and used for irrigating lands near Utah Lake.

SPANISH FORK NEAR SPANISH FORK, UTAH.

This station was established May 23, 1900, and reestablished March 26, 1903. It is located 600 feet above the dam of the East Bench Irrigation Company, 5 miles southeast of Spanish Fork, and 300 feet southwest of the main line of the Rio Grande Western Railway.

Records at this station are of importance in connection with the Strawberry Valley storage reservoir project, under a plan to divert water from that basin into Spanish Fork near its head and carry it to distribution canals below. The conditions and the bench marks are described in Water-Supply Paper No. 176, page 60, where are given also references to publications that contain data for previous years.

Discharge measurements of Spanish Fork near Spanish Fork, Utah, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
1906.		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 20	W. G. Swendsen	34.5	23.4	1.49	75.8
February 4	do	35.5	27.3	1.48	69.6
March 3	do	34.5	25.5	1.40	57.5
March 22	do	36.1	32.5	1.55	109
April 28	H. S. Kleinschmidt	39.5	73.4	2.40	343
May 10	do	48.0	122	3.74	801
May 19	Thos. Grieve, jr	46.0	125	3.74	693
June 2	do	40.0	94.5	2.85	472
June 12	do	39.0	80.0	2.50	338
July 3	do	38.0	45.5	1.70	177
August 7	do	37.0	30.4	1.40	96
October 17	do	37.0	27.5	1.25	90

Daily gage height, in feet, of Spanish Fork near Spanish Fork, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.45	1.45	1.55	2.0	2.5	2.8	1.75	1.45	1.35	1.25	1.25	1.25
2	1.55	1.4	1.5	2.0	2.45	2.8	1.7	1.4	1.5	1.25	1.25	1.3
3	1.4	1.4	1.4	1.8	2.6	2.75	1.7	1.4	1.45	1.25	1.25	1.3
4	1.4	1.45	1.5	1.6	3.05	2.8	1.7	1.4	1.35	1.25	1.3	1.4
5	1.4	1.5	1.45	1.8	3.5	2.85	1.7	1.35	1.35	1.25	1.3	1.35
6	1.5	1.5	1.45	1.8	3.6	2.85	1.65	1.35	1.35	1.25	1.3	1.3
7	1.4	1.5	1.4	2.2	3.58	2.65	1.65	1.35	1.35	1.25	1.3	1.25
8	1.5	1.45	1.45	2.2	3.9	2.6	1.6	1.3	1.35	1.25	1.3	1.25
9	1.5	1.45	1.5	2.2	3.9	2.5	1.6	1.3	1.35	1.25	1.3	1.25
10	1.4	1.45	1.6	2.4	4.4	2.55	1.6	1.3	1.35	1.25	1.3	1.25
11	1.35	1.5	2.2	2.5	4.4	2.5	1.55	1.3	1.3	1.25	1.3	1.25
12	1.4	1.5	2.25	2.4	4.5	2.5	1.55	1.3	1.3	1.25	1.25	1.25
13	1.4	1.5	2.25	2.2	4.5	2.45	1.5	1.3	1.3	1.25	1.25	1.4
14	1.45	1.5	1.6	2.25	3.9	2.45	1.5	1.4	1.3	1.25	1.25	1.25
15	1.4	1.55	1.5	2.4	3.9	2.4	1.6	1.35	1.35	1.25	1.25	1.1
16	1.4	1.55	1.45	2.45	3.85	2.35	1.55	1.35	1.45	1.25	1.25	1.1
17	1.4	1.5	1.5	2.8	3.8	2.2	1.5	1.35	1.35	1.25	1.25	1.1
18	1.4	1.55	1.5	3.2	3.8	2.12	1.6	1.35	1.35	1.25	1.2	1.1
19	1.55	1.6	1.3	3.1	3.8	2.05	1.55	1.4	1.35	1.25	1.15	1.2
20	1.55	1.45	1.45	3.0	3.95	2.0	1.5	1.65	1.3	1.25	1.2	1.25
21	1.4	1.55	1.5	3.0	4.0	1.9	1.5	1.45	1.3	1.25	1.2	1.25
22	1.4	1.5	1.6	3.1	3.9	1.85	1.5	1.5	1.3	1.2	1.2	1.25
23	1.4	1.5	2.0	3.3	3.65	1.85	1.5	1.4	1.3	1.2	1.2	1.25
24	1.45	1.45	2.35	3.25	3.6	1.85	1.65	1.35	1.3	1.2	1.2	1.25
25	1.5	1.5	2.8	2.9	3.35	1.8	1.5	1.35	1.3	1.25	1.25	1.25
26	1.45	1.45	2.3	2.75	3.2	1.8	1.5	1.35	1.3	1.25	1.25	1.4
27	1.5	1.5	2.0	2.55	3.25	1.8	1.45	1.35	1.3	1.25	1.25	1.5
28	1.45	1.5	1.9	2.5	3.3	1.8	1.45	1.35	1.3	1.25	1.25	1.4
29	1.45	.....	1.8	2.55	3.2	1.8	1.45	1.35	1.3	1.25	1.25	1.35
30	1.5	.....	1.9	2.5	3.1	1.8	1.45	1.3	1.25	1.25	1.25	1.3
31	1.45	.....	2.0	.....	2.85	.....	1.4	1.4	.....	1.25	.....	1.3

Daily discharge, in second-feet, of Spanish Fork near Spanish Fork, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	68	68	89	233	368	456	169	112	96	81	81	81
2	89	57	78	233	354	454	158	104	120	81	81	88
3	57	57	57	177	393	426	158	104	112	81	81	88
4	57	68	80	122	515	439	158	104	96	81	88	104
5	57	78	70	177	637	452	158	96	96	81	88	96
6	78	78	74	177	665	452	148	96	96	81	88	88
7	57	78	74	288	658	398	148	96	96	81	88	81
8	78	68	75	288	743	385	138	88	96	81	88	81
9	78	68	85	288	742	358	138	88	96	81	88	81
10	57	68	110	344	874	372	138	88	96	81	88	81
11	48	78	278	372	874	358	129	88	88	81	88	81
12	57	78	292	344	907	358	129	88	88	81	81	81
13	57	78	294	288	905	344	120	88	88	81	81	104
14	68	78	116	302	743	344	120	104	88	81	81	81
15	57	89	93	344	741	331	138	96	96	81	81	62
16	57	89	80	357	747	318	129	96	112	81	81	62
17	57	78	94	455	724	277	120	96	96	81	81	62
18	57	89	95	567	722	257	138	96	96	81	74	62
19	89	100	53	538	720	240	129	104	96	81	68	74
20	89	68	84	510	750	227	120	148	88	81	74	81
21	57	89	96	510	765	203	120	112	88	81	74	81
22	57	78	123	538	740	192	120	120	88	74	74	81
23	57	78	233	594	672	192	120	104	88	74	74	81
24	68	68	328	580	660	192	148	96	88	74	74	81
25	78	78	455	483	593	180	120	96	88	81	81	81
26	68	68	316	442	555	180	120	96	88	81	81	104
27	78	78	233	385	570	180	112	96	88	81	81	120
28	68	78	215	372	585	180	112	96	88	81	81	104
29	68	.....	177	382	560	180	112	96	88	81	81	96
30	78	.....	215	368	533	180	112	88	81	81	81	88
31	68	.....	233	.....	467	.....	104	104	.....	81	.....	88

NOTE.—Daily discharge obtained by indirect method for shifting channels March 3 to May 19. Two rating curves were used for the periods preceding and following March 3 and May 19, respectively.

Monthly discharge of Spanish Fork near Spanish Fork, Utah, for 1906.

[Drainage area, 670 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec-ft. per sq. mile.	Depth in inches.
January	89	48	66.4	4,080	0.099	0.11
February	100	57	76.0	4,220	.113	.12
March	455	53	158	9,720	.236	.27
April	594	122	369	22,000	.551	.61
May	907	354	661	40,600	.987	1.14
June	456	180	304	18,100	.454	.51
July	169	104	132.0	8,120	.197	.23
August	148	88	99.5	6,120	.149	.17
September	120	81	93.6	5,570	.139	.16
October	81	74	80.3	4,940	.120	.14
November	88	68	81.0	4,820	.121	.14
December	120	62	84.7	5,210	.126	.15
The year	907	48	184.0	134,060	.274	3.75

SPANISH FORK NEAR LAKE SHORE, UTAH.

This station was established December 10, 1903, at the highway bridge on the road between Spanish Fork and Lake Shore, about 3 miles west of Spanish Fork. In May, 1904, it was reestablished at a point about 800 feet above the bridge.

As the entire normal summer flow is diverted at a point above, the station is maintained only during the spring and winter, the object being the determination of the amount of water discharged by Spanish Fork into Utah Lake.

The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 63, where are given also references to publications that contain data for previous years.

Discharge measurements of Spanish Fork near Lake Shore, Utah, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 20	W. G. Swendsen	27.0	26.5	4.53	72.2
February 3	do	27.0	25.6	4.48	65.3
March 2	do	30.0	31.3	4.50	83.1
March 23	do	37.5	60.9	5.41	181
April 28	H. S. Kleinschmidt	52.0	123	7.25	352
June 12	Thos. Grieve, jr	24.0	10.0	4.20	12.6

Daily gage height, in feet, of Spanish Fork near Lake Shore, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Nov.	Dec.
1		4.40	4.53	5.35	7.2	6.05	4.35	4.70
2	4.30	4.35	4.48	5.3	7.15	5.87	4.40	4.90
3		4.48	4.45	5.2	7.35	5.7	4.40	4.90
4		4.42	4.50	5.0	7.90	5.5	4.40	4.10
5	4.25	4.42	4.48	5.05	9.25	5.47	4.40	4.10
6		4.40	4.43	5.1	9.50	5.9	4.40	5.00
7		4.40	4.44	5.82	9.35	5.75	4.45	5.00
8		4.38	4.50	5.92	9.35	5.5	4.45	5.00
9		4.35	4.58	6.0	9.35	5.45	4.50	5.00
10		4.40	5.80	6.3	8.90	5.0	4.55	5.00
11		4.41	5.92	6.25	9.00	4.9	4.55	5.00
12	4.50	4.50	5.48	6.0	8.30	4.7	4.55	5.00
13		4.47	6.15	5.95	10.25	4.3	4.55	5.10
14	4.80	4.48	4.81	6.0	9.20	4.05	4.50	5.10
15	4.40	4.48	4.15	6.2	8.45	3.7	4.50	5.10
16	4.35	4.50	4.05	7.0	8.25		4.50	5.00
17	4.40	4.40	4.10	7.5	8.50	4.35	4.50	4.90
18	4.40	4.45	4.20	7.7	8.00	4.0	4.50	4.90
19	4.52	4.60	4.15	7.72	8.00		4.50	4.90
20	4.57	4.48	4.45	7.75	8.20		4.50	4.90
21	4.57	4.48	4.50	7.95	9.00		4.50	4.90
22	4.28	4.50	4.53	8.4	8.45		4.50	4.90
23	4.50	4.52	5.42	8.8	8.05		4.50	4.80
24	4.40	4.50	5.90	8.4	7.70		4.50	4.90
25	4.40	4.45	6.90	8.6	7.35		4.50	4.90
26	4.37	4.41	6.10	7.7	7.20		4.50	5.20
27	4.38	4.48	5.53	7.4	6.80		4.50	5.20
28	4.41	4.45	5.58	7.25	7.15		4.70	5.10
29	4.40		5.40	7.35	7.30		4.70	5.10
30	4.40		5.38	7.4	6.90		4.70	5.00
31	4.40		5.47		6.50			5.00

NOTE.—Flow probably slightly affected by ice conditions during winter months.

Daily discharge, in second-feet, of Spanish Fork near Lake Shore, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	Nov.	Dec.
1	49	58	85	177	345	200	19	36
2	50	54	82	170	339	180	21	50
3	48	64	79	161	362	163	21	50
4	48	61	84	142	408	145	21	10
5	46	62	84	147	532	139	21	10
6	50	62	77	152	552	177	21	57
7	53	62	80	220	536	161	23	57
8	56	61	86	228	534	134	23	57
9	56	58	94	236	532	123	26	57
10	59	63	163	264	491	74	28	57
11	62	64	222	260	500	58	28	57
12	66	73	182	236	433	34	28	57
13	79	69	245	231	611	17	28	65
14	92	74	119	236	513	8	26	65
15	58	74	58	255	443	3	26	65
16	54	76	52	329	422	0	26	57
17	58	67	56	375	445	18	26	50
18	58	72	64	395	398	6	26	50
19	68	87	61	397	397	.....	26	50
20	72	75	88	400	416	.....	26	50
21	72	75	94	420	388	.....	26	50
22	49	79	97	460	335	.....	26	50
23	66	81	181	496	397	.....	26	42
24	58	80	226	460	366	.....	26	50
25	58	76	319	478	333	.....	26	50
26	56	73	245	395	318	.....	26	74
27	56	81	193	367	280	.....	26	74
28	59	77	198	352	322	.....	36	65
29	58	.....	180	361	326	.....	36	65
30	58	.....	179	364	280	.....	36	57
31	58	.....	186	.....	222	.....	.....	57

NOTE.—Total flow of river diverted for irrigation June 19 to October 31. Daily discharge obtained by indirect method for shifting channels. Open-channel rating applied during winter period which may give results which are somewhat too large.

Monthly discharge of Spanish Fork near Lake Shore, Utah, for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	92	46	59.0	3,630
February	87	54	69.9	3,880
March	319	52	134	8,240
April	496	142	305	18,100
May	552	242	419	25,800
June	200	00	54.7	3,250
July	0	0	0	0
August	0	0	0	0
September	0	0	0	0
October	0	0	0	0
November	36	19	26.0	1,550
December	74	10	52.9	3,250
The year	552	0	93.4	67,700

SEVIER RIVER BASIN.

DESCRIPTION OF BASIN.

Sevier River rises in the northwestern part of Kane County, in southern Utah, flows northeastward to a point near Gunnison, northwestward nearly to Leamington, and then turns sharply to the southwest and discharges into Sevier Lake.

Tributary streams are few, San Pitch River and Salina Creek being the most important. The San Pitch joins the main stream

about 3 miles above the gaging station, but since its flow is used for irrigation and is completely controlled by storage reservoirs, it furnishes little of the supply. Salina Creek, which enters about 15 miles above the station, is subject to rapid run-off and during flood seasons carries an immense amount of sediment.

There is considerable irrigation from the Sevier above Gunnison, and a few small storage reservoirs control the flood discharge.

SEVIER RIVER NEAR GUNNISON, UTAH.

This station was established June 29, 1900. It is located at the wagon bridge over the Sevier about 4 miles west of Gunnison, on the road to Westview precinct. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 65, where are given also references to publications that contain data for previous years.

Discharge measurements of Sevier River near Gunnison, Utah, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 25	H. S. Kleinschmidt	60	210	3.52	563
May 21	C. Tanner	78	404	5.65	1,770
May 29	Thos. Grieve, jr	79	519	6.27	2,530
July 17	do	42	126	.95	42

Daily gage height, in feet, of Sevier River near Gunnison, Utah, for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	.....	2.38	.....	2.90	3.50	5.7	3.80	.....	2.00	2.60	2.40	2.72
2	.....	2.38	.....	2.80	3.60	5.66	3.70	.....	2.00	2.58	2.46	2.76
3	.....	2.38	1.60	2.74	3.74	5.62	3.70	2.00	2.02	2.54	2.44	2.80
4	2.06	2.38	.....	2.72	3.76	5.40	3.70	1.90	2.04	2.54	2.40	2.80
5	.....	2.38	1.46	2.70	3.80	5.36	.....	1.90	2.22	2.52	2.42	2.86
6	.....	2.38	1.74	2.90	3.86	5.10	3.68	1.84	2.30	2.50	2.40	2.86
7	2.08	2.38	1.82	3.30	3.90	5.06	3.62	1.80	2.30	2.42	2.36	2.84
8	.....	2.38	1.86	3.20	3.84	4.96	3.62	1.80	2.30	2.30	2.36	2.90
9	.....	2.38	2.02	3.22	3.94	4.70	3.62	1.76	2.20	2.80	2.34	2.90
10	4.16	2.40	2.06	3.24	4.04	4.72	3.00	1.70	2.20	2.26	2.34	2.86
11	.....	2.50	2.78	3.26	4.10	4.80	2.70	1.64	2.10	2.22	2.36	2.84
12	.....	2.62	2.78	3.14	4.26	4.72	.....	1.75	1.96	2.20	2.30	2.82
13	.....	2.80	2.72	3.16	4.56	4.78	.....	1.70	1.90	2.06	2.30	2.82
14	4.00	2.90	2.58	3.06	4.56	4.70	.....	1.70	1.90	2.02	2.30	2.82
15	.....	2.82	2.40	3.02	4.76	4.68	.....	1.72	1.90	2.00	2.32	2.80
16	.....	2.82	.....	3.04	4.90	4.66	.....	1.72	2.06	2.04	2.30	2.80
17	.....	2.76	2.20	3.20	5.10	4.66	.95	1.70	2.42	2.06	2.32	2.80
18	.....	2.74	2.28	3.22	5.30	4.64	1.00	1.64	2.40	2.10	2.32	2.80
19	.....	2.50	2.24	3.20	5.44	4.50	1.20	1.70	2.40	2.14	.....	2.82
20	3.70	2.50	2.24	3.24	5.60	4.20	1.12	1.90	2.44	2.12	2.34	2.82
21	.....	2.46	2.38	3.24	5.72	4.10	1.14	2.12	2.44	2.16	2.30	2.86
22	3.00	2.40	2.44	3.26	5.86	3.90	1.22	2.20	2.40	2.20	2.34	2.84
23	.....	2.20	2.50	3.40	5.90	3.78	1.24	2.20	2.60	2.20	2.34	2.80
24	2.46	2.20	2.56	3.44	6.00	3.60	1.32	2.90	2.60	2.18	2.46	2.80
25	2.44	2.08	2.70	3.50	6.06	3.46	1.24	3.10	2.60	2.20	2.60	2.82
26	2.40	2.20	2.76	3.44	6.20	3.40	1.20	2.90	2.60	2.22	2.60	2.80
27	2.40	2.00	2.84	3.34	.....	3.18	1.34	2.50	2.60	2.22	2.60	.....
28	.....	2.00	2.90	3.34	6.34	3.10	1.34	2.36	2.60	2.24	2.64	.....
29	2.40	.....	2.92	3.36	.....	3.04	1.34	2.26	2.62	2.26	2.66	2.84
30	.....	.....	2.92	3.52	6.04	2.90	.....	2.26	2.62	2.26	2.66	2.84
31	.....	.....	2.90	.....	5.86	.....	.....	2.20	.....	2.28	.....	2.84

NOTE.—Ice conditions January 1-19. Ice about 0.4 foot thick.

SEVIER RIVER NEAR MARYSVALE, UTAH.

This station was established February 18, 1906. It is located about 200 yards from the main wagon road at Peter Pitt's ranch, about 6 miles above Marysvale, which is the nearest railway station.

The channel is straight for about 200 feet above the station and 100 feet below. The right bank, which is rather low, is covered with willows; the left has gentle slope and is clean. Neither bank is subject to overflow. The current is sluggish. The bed of the stream is composed of clay and may change during flood stages. Discharge measurements are made from a car on a cable marked at 5-foot intervals with red paint. The initial point for soundings is the inner face of the cable support on the left bank.

The gage, which is read by Mr. Peter Pitts, is a 4 by 4-inch post, graduated to feet and tenths, set in a vertical position directly under the cable.

Discharge measurements of Sevier River near Marysvale, Utah, in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 24	H. S. Kleinschmidt	55	221	4.85	673.0
July 19	Thos. Grieve, jr	49	128	3.94	266.0

Daily gage height, in feet, of Sevier River near Marysvale, Utah, for 1906.

Day.	Feb.	Mar.	Apr.	May.	June.	Day.	Feb.	Mar.	Apr.	May.	June.
1		2.78	2.60	5.00	7.27	17		2.50	3.00		5.40
2		2.60	2.70	4.80	6.97	18	2.73	2.55	3.25		5.30
3		2.40	2.60	4.70	6.77	19		2.50	3.40		5.10
4		2.45	2.60	4.70	6.65	20		2.45	3.60		4.95
5		2.45	2.55	4.90	6.52	21	2.70	2.52	3.75		4.80
6		2.35	2.55	5.20	6.52	22	2.70	2.55	4.00		4.70
7		2.32	2.80	5.40	6.55	23	2.50	2.55	4.30	8.57	4.40
8		2.40	2.95	5.55	6.52	24	2.50	2.60	4.70	8.47	4.20
9		2.40	2.90	5.80	6.17	25	2.50	2.80	5.00	8.42	4.00
10		2.50	2.90		6.00	26	2.50	3.05	5.10	8.17	3.80
11		2.50	2.90		6.00	27	2.55	3.00	5.00	7.87	3.75
12		2.55	2.90		6.17	28	2.60	2.80	4.90	7.85	3.65
13		2.50	2.90		5.90	29		2.70	4.90	7.92	3.60
14		2.60	2.80		5.90	30		2.70	5.10	7.97	3.40
15		2.60	2.80		5.60	31		2.65		7.59	
16		2.60	2.90		5.50						

NOTE.—May 10–22 water was over the top of the gage rod.

BEAVER CREEK DRAINAGE BASIN.

DESCRIPTION OF BASIN.

Beaver Creek with its tributaries, North, South, and Indian creeks, rises on the western slope of the Tushar Mountains, and flows in a westerly direction to Minersville, thence northerly until its waters are lost in the sands.

Measurements were made of these streams in 1906 by Mr. J. F. Hoyt, in connection with an investigation of the water resources of the valley for irrigation purposes.

BEAVER CREEK NEAR BEAVER, UTAH.

This was a temporary station established June 15 and discontinued September 22, 1906. It was located at the mouth of Pink Stone Hollow, 5 miles east of Beaver, Utah.

Discharge measurements of Beaver Creek near Beaver, Utah, in 1906.

Month.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
June 13	5.35	612
July 2	4.00	164
August 14	3.35	78
August 25	3.28	62

Daily gage height, in feet, of Beaver Creek near Beaver, Utah, for 1906.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1		4.0	3.6	3.2	17	4.95	3.65	3.3	3.2
2		3.95	3.55	3.25	18	4.8	3.65	3.3	3.2
3		3.95	3.5	3.2	19	4.75	3.6	3.3	3.2
4		3.95	3.4	3.2	20	4.65	3.6	3.4	3.2
5		3.9	3.4	3.2	21	4.62	3.55	3.55	3.1
6		3.9	3.4	3.2	22	4.55	3.55	3.5	3.1
7		3.85	3.4	3.15	23	4.5	3.55	3.35	.....
8		3.8	3.4	3.15	24	4.4	3.55	3.3	.....
9		3.8	3.4	3.15	25	4.35	3.5	3.3	.....
10		3.8	3.35	3.1	26	4.3	3.45	3.3	.....
11		3.75	3.35	3.1	27	4.3	3.45	3.25	.....
12		3.75	3.35	3.1	28	4.25	3.55	3.25	.....
13		3.75	3.3	3.1	29	4.12	3.5	3.25	.....
14		3.75	3.3	3.1	30	4.08	3.4	3.25	.....
15	5.2	3.7	3.3	3.1	31		3.5	3.35	.....
16	5.1	3.7	3.3	3.2					

Rating table for Beaver Creek near Beaver, Utah, for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.10	52	3.60	103	4.10	183	4.50	269	4.90	399
3.20	59	3.70	117	4.20	202	4.60	297	5.00	439
3.30	68	3.80	132	4.30	222	4.70	328	5.10	482
3.40	78	3.90	148	4.40	244	4.80	362	5.20	528
3.50	90	4.00	165						

NOTE.—This table is based on 4 discharge measurements and is not well defined.

Monthly discharge of Beaver Creek near Beaver, Utah, for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
June (15-30)	528	179	300	9,520
July	165	78	117	7,190
August	103	63	74.8	4,600
September (1-22)	63	52	56.1	2,450
The period				23,800

BEAVER CREEK NEAR MINERSVILLE, UTAH.

The following measurement was made June 21, 1906, at the county bridge, 1½ miles east of Minersville. During the late summer Minersville Canal diverts most of the flow of the creek 200 feet above the bridge.

Area, 64 square feet; discharge, 211 second-feet.

MINERSVILLE CANAL AT MINERSVILLE, UTAH.

This was a temporary station established June 21 and discontinued September 21, 1906. It was located at the old flour mill flume, three-fourths of a mile east of Minersville.

The gage was fastened to the north side of the flume with the zero coinciding with the bottom.

The following measurements were made during 1906:

June 21....Gage height..1.50 feet; discharge, 41 second-feet.
August 21....Gage height..0.93 foot; discharge, 32.5 second-feet.

Daily gage height, in feet, of Minersville Canal near Minersville, Utah, for 1906.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1		1.6	0.9	1.4	17			0.9	1.15
2		1.6		1.5	18		1.1		1.1
3		1.6	.9	1.4	19			.9	1.05
4				1.4	20		1.1		
5		1.6	.9	1.4	21	1.6		.9	1.0
6		1.6		1.35	22	1.6	1.1	1.0	
7		1.6	.9	1.35	23			1.1	
8		1.6		1.35	24	1.5	1.1	1.3	
9		1.6	.9	1.35	25	1.6		1.3	
10		1.6		1.3	26	1.6	1.1	1.3	
11			.9	1.3	27	1.6		1.3	
12		1.1		1.3	28		1.0	1.3	
13			.9	1.3	29	1.6		1.3	
14		1.1		1.3	30	1.6	.9	1.3	
15			.9	1.3	31			1.3	
16		1.1		1.15					

Monthly discharge of Minersville Canal near Minersville, Utah, for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
June (21-30)	43	41	42.7	847
July	43	32	37.3	2,290
August	38	32	33.7	2,070
September (1-21)	41	33	37.6	1,570
The period				6,780

NOTE.—These values are based on very meager data and are only approximate.

NORTH FORK OF NORTH CREEK NEAR BEAVER, UTAH.

This was a temporary station established June 16 and discontinued September 27, 1906. It was located one-half mile east of T. J. Shy's fence along the wagon road and 8 miles northeast of Beaver.

Discharge measurements of North Fork of North Creek near Beaver, Utah, in 1906.

Date.	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
June 23	2.80	3.2
August 18	2.25	3.6
August 27	2.25	3.0

Daily gage height, in feet, of North Fork of North Creek, near Beaver, Utah, for 1906.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1		2.0	2.2	2.25	17	2.9	2.3	2.0	2.1
2		2.6	2.2	2.32	18	2.8	2.2	2.18	2.1
3		2.6	2.2	2.22	19	2.8	2.2	2.1	2.1
4		2.6	2.1	2.35	20	3.0	2.0	2.2	2.1
5		2.6	2.1	2.36	21	2.9	2.2	2.3	2.1
6		2.5	2.1	2.35	22	2.9	2.2	2.3	2.1
7		2.5	2.1	2.34	23	2.8	2.1	2.3	2.1
8		2.5	2.1	3.24	24	2.6	2.2	2.3	2.1
9		2.5	2.1	3.25	25	2.7	2.2	2.3	2.2
10		2.5	2.1	2.0	26	2.6	2.2	2.4	2.2
11		2.5	2.1	1.9	27	2.6	2.2	2.3	2.2
12		2.4	2.0	1.95	28	2.6	2.2	2.3	
13		2.4	2.0	1.9	29	2.6	1.9	2.3	
14		2.4	2.0	1.9	30	2.6	1.9	2.32	
15		2.4	2.0	1.9	31		1.9	2.3	
16	3.0	2.4	2.0	1.9					

Monthly discharge of North Fork of North Creek, near Beaver, Utah, for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
June (16–30)	52	17	29.9	890
July	17	.2	6.8	418
August	7.7	.5	2.7	166
September (1–27)	84	.2	8.3	445
The period				1,910

NOTE.—These values are based on very meager data and are only approximate.

SOUTH FORK OF NORTH CREEK, NEAR BEAVER, UTAH.

This was a temporary station established June 16 and discontinued September 27, 1906. It was located 100 feet east of "The Narrows" of South Fork Canyon, 8 miles northeast of Beaver, Utah.

Discharge measurements of South Fork of North Creek, near Beaver, Utah.

	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
June 23	3.40	90
August 18	2.25	17.3
August 27	2.20	16.1

Daily gage height, in feet, of South Fork of North Creek, near Beaver, Utah, for 1906.

Day.	June.	July.	Aug.	Sept.	Day.	June.	July.	Aug.	Sept.
1		3.1	2.4	2.32	17	3.6	2.7	2.5	2.3
2		3.1	2.4	2.32	18	3.6	2.7	2.4	2.2
3		3.1	2.3	2.22	19	3.6	2.6	2.4	2.2
4		3.1	2.3	2.35	20	3.7	2.4	3.5	2.2
5		3.9	2.3	2.35	21	3.7	2.4	2.45	2.2
6		2.8	2.3	2.34	22	3.6	2.3	2.4	2.2
7		2.8	2.4	2.34	23	3.4	2.4	2.4	2.3
8		2.8	2.4	2.34	24	3.2	2.4	2.4	2.3
9		2.8	2.4	2.35	25	3.1	2.4	2.4	2.3
10		2.8	2.4	2.25	26	3.0	2.4	2.4	2.3
11		2.8	2.4	2.24	27	2.9	2.4	2.2	2.3
12		2.8	2.4	2.25	28	3.0	2.4	2.3	
13		2.8	2.6	2.25	29	2.9	2.4	2.3	
14		2.7	2.5	2.25	30	2.8	2.4	2.3	
15		2.7	2.5	2.25	31		2.4		
16	3.8	2.7	2.4	2.25					

Monthly discharge of South Fork of North Creek, near Beaver, Utah, for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
June 16-30	152	39	88.1	2,620
July	168	18	37.6	2,310
August	102	16	23.4	1,390
September 1-27	19	16	17.5	937
The period				7,260

NOTE.—These values are based on meager data and are only approximate.

SOUTH CREEK, NEAR BEAVER, UTAH.

This was a temporary station established June 18 and discontinued September 18, 1906. It was located 900 feet east of Cox Brothers' ranch house and 8 miles southeast of Beaver.

	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
June 18	1.20	26.8
July 6	.70	6.8
July 31	.51	2.8
August 25	.45	3.1

INDIAN CREEK, NEAR BEAVER, UTAH.

This was a temporary station established June 26 and discontinued August 31, 1906. It was located 190 feet above the head of Beaumont ditch and 12 miles north of Beaver.

Discharge measurements of Indian Creek, near Beaver, Utah.

	Gage height.	Discharge.
	Feet.	*Sec.-ft.*
June 26	0.95	21.3
August 18	.65	4.6
August 21	.61	3.9

Daily gage height, in feet, of Indian Creek, near Beaver, Utah, for 1906.

Day.	June.	July.	Aug.	Day.	June.	July.	Aug.
1			0.73	17		0.79	
2		0.88		18			0.64
3				19			
4				20			
5		.85	.70	21			.70
6		.84		22			
7				23		.71	
8			.67	24			
9				25		.71	
10		.80		26	0.95		
11			.65	27		.72	.61
12				28	.92	.73	.61
13				29			
14		.78		30	.90		
15				31		.74	.63
16							

Monthly discharge of Indian Creek, near Beaver, Utah, for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
June (26–30)	21	16.5	18.4	182
July	15.5	6.3	9.4	578
August	7.0	4.0	5.1	314
The period				1,070

NOTE.—These values are based on very meager data and are only approximate.

HUMBOLDT SINK DRAINAGE.

The only stream of importance draining into Humboldt Sink is Humboldt River, the basin of which is described below.

HUMBOLDT RIVER BASIN.

DESCRIPTION OF BASIN.

Humboldt River rises in the extreme northeastern part of Nevada, flows west and southwest across the structural features of the country, and enters Humboldt Lake, whence its waters find their way into Humboldt Sink. The tributaries follow the general direction of the mountain ranges and flow either to the north or to the south. During low stages the water of the river is almost wholly diverted and for the future development of the country recourse must be had to the construction of storage reservoirs.

Of the tributaries North Fork enters the stream west of Peko, Nev., and South Fork about 10 miles below Elko. Pine Creek comes in from the south near Palisade, Nev. Marys River is one of the headwater branches.

NORTH FORK OF HUMBOLDT RIVER NEAR ELBURZ, NEV.

This station was established October 10, 1902. It is located about one-fourth mile above the junction of North Fork with the main river and 150 feet below the Southern Pacific Railroad bridge. It is

2 miles west of the Southern Pacific Railroad station at Elburz. The nearest post-office is Halleck, Nev. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 70, where are given also references to publications that contain data for previous years.

Discharge measurements of North Fork of Humboldt River near Elburz, Nev., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 28	M. B. Kennedy	40	100	4.35	176
June 25	do	40	90	4.30	122
July 9	do	37	46	3.60	60
August 7	do	35	13	2.95	11.8

Daily gage height, in feet, of North Fork of Humboldt River near Elburz, Nev., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	3.5	4.0	3.8	4.5	4.6	4.5	4.2	3.0	2.5	2.5	2.55	2.85
2	3.5	4.0	3.8	4.5	4.5	4.5	4.1	3.0	2.5	2.5	2.55	2.85
3	3.5	4.0	3.8	4.4	4.5	4.5	4.0	3.0	2.5	2.5	2.55	2.9
4	3.5	4.0	3.8	4.4	4.5	4.5	4.0	3.0	2.5	2.5	2.55	2.9
5	3.5	4.0	3.8	4.4	4.5	4.4	3.9	3.0	2.5	2.5	2.55	2.95
6	3.5	4.0	3.8	4.3	4.5	4.4	3.8	2.95	2.5	2.5	2.6	2.95
7	3.5	4.0	3.8	4.3	4.4	4.3	3.7	2.9	2.5	2.5	2.6	3.0
8	3.5	4.0	3.8	4.4	4.4	4.3	3.7	2.9	2.5	2.5	2.6	3.1
9	3.5	4.0	3.8	4.5	4.35	4.3	3.65	2.85	2.5	2.5	2.65	3.1
10	3.5	4.0	3.8	5.0	4.3	4.3	3.6	2.85	2.5	2.5	2.65	3.1
11	3.5	4.0	3.8	5.4	4.2	4.2	3.6	2.85	2.5	2.5	2.65	3.15
12	3.5	4.0	3.7	5.3	4.1	4.2	3.55	2.85	2.5	2.5	2.65	3.15
13	3.5	4.0	3.7	5.2	4.1	4.1	3.5	2.85	2.5	2.5	2.65	3.2
14	3.5	4.0	3.6	5.0	4.1	4.2	3.5	2.85	2.5	2.5	2.65	3.2
15	3.6	4.0	3.6	5.0	4.0	4.2	3.45	2.8	2.5	2.5	2.7	3.2
16	3.6	4.0	3.6	5.0	4.0	4.3	3.4	2.8	2.5	2.5	2.7	3.2
17	3.8	4.0	3.6	5.0	4.1	4.3	3.4	2.8	2.5	2.5	2.7	3.2
18	3.9	4.0	3.6	4.9	4.1	4.4	3.35	2.8	2.5	2.5	2.7	3.2
19	4.0	4.0	3.6	4.9	4.1	4.6	3.35	2.8	2.5	2.5	2.7	3.2
20	4.0	4.0	3.6	5.0	4.1	4.9	3.3	2.75	2.5	2.5	2.7	3.2
21	4.0	3.9	3.7	5.0	4.1	4.9	3.3	2.75	2.5	2.5	2.7	3.2
22	4.0	3.8	3.7	5.0	4.0	4.8	3.25	2.7	2.5	2.5	2.7	3.2
23	4.0	3.8	3.8	5.0	4.0	4.7	3.25	2.65	2.5	2.5	2.7	3.2
24	4.0	3.7	3.8	4.9	4.0	4.5	3.2	2.6	2.5	2.5	2.7	3.2
25	4.0	3.7	4.0	4.85	4.0	4.3	3.2	2.6	2.5	2.5	2.75	3.2
26	4.0	3.75	4.7	4.85	4.0	4.3	3.15	2.6	2.5	2.5	2.75	3.2
27	4.0	3.8	6.4	4.8	4.1	4.25	3.1	2.6	2.5	2.5	2.8	3.2
28	4.0	3.8	4.6	4.7	4.3	4.2	3.1	2.55	2.5	2.5	2.8	3.2
29	4.0	.....	4.6	4.7	4.4	4.2	3.1	2.55	2.5	2.5	2.8	3.2
30	4.0	.....	4.5	4.6	4.5	4.2	3.1	2.5	2.5	2.5	2.85	3.2
31	4.0	.....	4.5	.....	4.5	.....	3.05	2.5	.....	2.5	.....	3.2

NOTE.—There was probably obstruction from ice during the winter months, to what extent is not known.

Rating table for North Fork of Humboldt River near Elburz, Nev., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.50	0	3.10	21	3.70	70	4.30	142	4.90	237
2.60	1	3.20	28	3.80	80	4.40	156	5.00	255
2.70	3	3.30	35	3.90	91	4.50	171	5.10	274
2.80	6	3.40	43	4.00	103	4.60	186	5.20	294
2.90	10	3.50	51	4.10	115	4.70	202	5.30	314
3.00	15	3.60	60	4.20	128	4.80	219	5.40	334

NOTE.—This table is applicable only for open-channel conditions. It is based on 4 discharge measurements made during 1906 and is not well defined.

Monthly discharge of North Fork of Humboldt River near Elburz, Nev., for 1906.

[Drainage area, 1,020 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	103	51	75.6	4,650	0.074	0.09
February	103	70	95.9	5,330	.094	.10
March	202	60	95	5,840	.093	.11
April	334	142	221	13,200	.217	.24
May	186	103	134	8,240	.131	.15
June	237	115	156	9,280	.153	.17
July	128	18	52.6	3,230	.052	.06
August	15	0	65.5	403	.0064	.01
September	0	0	0	0	.000	.00
October	0	0	0	0	.000	.00
November	8	.5	2.76	164	.0027	.003
December	28	8	23.2	1,430	.023	.03
The year	334	0	71.8	51,800	.070	.96

NOTE.—The open-channel rating table was applied throughout the year; values for winter months are liable to some error on account of ice.

SOUTH FORK OF HUMBOLDT RIVER NEAR ELKO, NEV.

This station was established August 29, 1896. It is located 10 miles southwest of the town of Elko, at Cislini's (formerly Mason's) ranch, and about 6 miles above the junction of South Fork with the main stream. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, p. 72, where are given also references to publications that contain data for previous years.

Discharge measurements of South Fork of Humboldt River near Elko, Nev., for 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 27	M. B. Kennedy	42	98	3.20	427
June 23	do	45	131	4.80	571
July 10	do	44	109	3.30	424
August 8	do	14	11.4	1.00	9.9

Daily gage height, in feet, of South Fork of Humboldt River near Elko, Nev., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Oct.	Nov.	Dec.
1	1.1	1.2	2.2	3.0	2.8	3.1	3.9	1.8	.....	1.1	1.1
2	1.1	1.2	2.0	2.9	2.7	3.4	3.9	1.8	.....	1.1	1.1
3	1.1	1.2	2.0	2.8	2.7	3.5	3.9	1.8	1.0	1.1	1.1
4	1.1	1.2	2.0	2.7	2.8	3.6	3.8	1.8	1.0	1.1	1.1
5	1.1	1.2	1.7	2.5	2.9	3.7	3.8	1.7	1.0	1.1	1.1
6	1.1	1.2	1.7	2.5	3.0	3.8	3.8	1.6	1.0	1.1	1.1
7	1.1	1.2	1.7	2.5	3.1	3.8	3.8	1.2	1.0	1.1	1.1
8	1.1	1.2	1.8	2.6	3.2	3.9	3.7	1.0	1.0	1.1	1.1
9	1.1	1.2	1.8	2.7	3.2	4.0	3.7	1.0	1.0	1.1	1.1
10	1.1	1.2	2.0	2.8	3.4	4.0	3.7	1.0	1.0	1.1	1.1
11	1.1	1.2	2.0	2.8	3.4	4.1	3.6	.....	1.0	1.1	1.1
12	1.1	1.2	2.0	2.9	3.4	4.2	3.6	.....	1.0	1.1	1.1
13	1.1	2.0	2.0	3.0	3.2	4.4	3.6	.....	1.0	1.1	1.1
14	1.1	2.0	1.9	3.0	3.1	4.5	3.6	.....	1.0	1.1	1.1
15	1.1	2.0	1.9	3.0	3.0	4.7	3.5	.....	1.0	1.1	1.1
16	1.1	2.0	1.8	3.0	3.0	5.0	3.4	.....	1.0	1.1	1.1
17	1.1	2.0	1.8	3.0	3.0	5.0	3.3	.....	1.0	1.1	1.1
18	1.1	2.1	1.8	3.0	2.9	5.0	3.2	.....	1.0	1.1	1.1
19	1.1	2.2	2.0	3.0	2.8	5.0	3.1	.....	1.0	1.1	1.1
20	1.1	2.2	2.6	3.0	2.8	5.0	3.0	.....	1.0	1.1	1.1
21	1.1	2.2	2.8	3.0	2.9	5.0	2.9	.....	1.1	1.1	1.1
22	1.1	2.2	2.8	3.0	3.0	5.0	2.8	.....	1.1	1.1	1.1
23	1.1	2.2	3.0	3.0	3.0	5.0	2.6	.....	1.1	1.1	1.1
24	1.1	2.2	3.0	3.0	3.0	5.0	2.3	.....	1.1	1.1	1.1
25	1.1	2.2	3.0	3.0	3.0	4.8	2.1	.....	1.1	1.1	1.1
26	1.1	2.2	3.0	3.0	3.0	4.8	2.0	.....	1.1	1.1	1.1
27	1.1	2.1	3.0	2.9	3.2	4.7	1.8	.....	1.1	1.1	1.1
28	1.2	2.1	2.8	2.8	3.2	4.7	1.8	.....	1.1	1.1	1.1
29	1.2	.....	2.8	2.8	3.2	4.7	1.8	.....	1.1	1.1	1.1
30	1.2	.....	2.9	2.8	3.3	4.7	1.8	.....	1.1	1.1	1.1
31	1.2	.....	3.0	.....	3.3	.....	1.8	.....	1.1	1.1	1.1

NOTE.—The river was dry August 11 to October 2.

Rating table for South Fork of Humboldt River near Elko, Nev., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	10	1.80	102	2.60	250	3.40	480	4.40	965
1.10	18	1.90	118	2.70	275	3.50	515	4.60	1,100
1.20	27	2.00	135	2.80	300	3.60	555	4.80	1,240
1.30	37	2.10	153	2.90	325	3.70	595	5.00	1,400
1.40	48	2.20	171	3.00	355	3.80	640		
1.50	60	2.30	190	3.10	385	3.90	685		
1.60	73	2.40	210	3.20	415	4.00	735		
1.70	87	2.50	230	3.30	445	4.20	845		

NOTE.—This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6 and is not well defined.

Monthly discharge of South Fork of Humboldt River near Elko, Nev., for 1906.

[Drainage area, 1,150 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	27	18	19.2	1,180	0.017	0.02
February	171	27	101	5,610	.088	.09
March	355	87	199	12,200	.173	.20
April	355	230	320	19,000	.278	.31
May	480	275	371	22,800	.323	.37
June	1,400	480	1,020	60,700	.887	.99
July	685	102	422	25,900	.367	.42
August	102	0	20.2	1,240	.018	.02
September	0	0	0	0	.000	.00
October	18	0	12.2	750	.011	.01
November	18	18	18.0	1,070	.016	.02
December	18	18	18.0	1,110	.016	.02
The year	1,400	0	210	152,000	.183	2.47

HUMBOLDT RIVER AT PALISADE, NEV.

This station was established November 27, 1902, and discontinued October 19, 1906. It is located at the single-span highway bridge one-fourth mile from the hotel at Palisade, Nev. There is a railroad bridge about 500 feet below. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, p. 74, where are given also references to publications that contain data for previous years.

Discharge measurements of Humboldt River at Palisade, Nev., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 26	M. B. Kennedy	105	432	4.50	1,010
June 25	do	108	632	5.90	1,940
July 10	do	102	453	4.65	1,080
August 8	do	87	96	2.20	108

Daily gage height, in feet, of Humboldt River at Palisade, Nev., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.
1	1.7	1.7	2.1	5.35	6.3	5.5	5.2	2.9	1.7	1.7
2	1.7	1.7	2.15	5.3	6.1	5.6	5.2	2.8	1.7	1.8
3	1.7	1.7	2.25	5.3	6.0	5.4	5.1	2.4	1.7	1.8
4	1.7	1.7	2.3	5.3	6.1	5.5	5.2	2.6	1.7	1.8
5	1.7	1.7	2.4	5.3	5.8	5.6	5.0	2.6	1.7	1.8
6	1.7	1.7	2.6	5.35	5.7	5.8	5.1	2.5	1.7	1.8
7	1.7	1.7	2.7	5.35	5.4	5.6	5.1	2.4	1.7	1.8
8	1.7	1.7	3.0	5.4	5.5	5.7	5.0	2.3	1.6	1.8
9	1.7	1.7	3.2	5.4	5.2	5.7	5.0	2.2	1.6	1.8
10	1.7	1.7	3.3	5.45	5.2	5.6	4.8	2.1	1.6	1.8
11	1.7	1.7	3.4	5.5	5.3	5.6	4.8	2.0	1.6	1.8
12	1.7	1.7	3.5	5.6	5.1	5.5	4.8	2.0	1.6	1.8
13	1.7	1.7	3.6	5.6	5.0	5.6	4.8	2.0	1.7	1.8
14	1.7	1.7	3.65	5.7	5.0	5.7	4.8	2.0	1.8	1.8
15	1.7	1.7	3.7	5.8	5.2	5.7	4.8	1.9	1.8	1.8
16	1.7	1.7	3.7	5.8	5.2	5.6	4.8	1.8	1.7	1.8
17	1.7	1.7	3.8	5.9	5.0	5.8	4.7	1.8	1.8	1.8
18	1.7	1.75	4.0	6.2	4.9	6.0	4.6	1.7	1.8	1.8
19	1.7	1.75	4.2	6.2	4.9	6.0	4.5	1.8	1.8	1.8
20	1.7	1.75	4.3	6.3	4.8	5.8	4.5	1.7	1.8	.....
21	1.7	1.8	4.4	6.3	4.7	5.9	4.5	1.8	1.7	.....
22	1.7	1.8	4.6	6.4	4.6	5.8	4.6	1.8	1.7	.....
23	1.7	1.8	4.8	6.2	4.7	5.8	4.4	1.8	1.7	.....
24	1.7	1.8	5.0	6.5	4.8	5.8	4.3	1.8	1.7	.....
25	1.7	1.85	5.0	6.6	4.7	5.7	4.1	1.8	1.7	.....
26	1.7	1.85	5.1	6.5	4.6	5.6	4.0	1.8	1.7	.....
27	1.7	1.9	5.1	6.6	4.9	5.4	3.8	1.8	1.7	.....
28	1.7	2.0	5.2	6.7	4.8	5.3	3.7	1.8	1.7	.....
29	1.7	.....	5.25	6.6	4.9	5.3	3.5	1.8	1.7	.....
30	1.7	.....	5.25	6.4	5.5	5.2	3.2	1.8	1.7	.....
31	1.7	.....	5.3	.....	5.5	.....	3.0	1.8	.....	.....

Rating tables for Humboldt River, at Palisade, Nev.

JANUARY 1, 1905, TO MARCH 23, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	34	1.80	139	2.50	308	3.20	534	3.90	807
1.20	46	1.90	159	2.60	337	3.30	570	4.00	850
1.30	59	2.00	180	2.70	367	3.40	607	4.20	940
1.40	72	2.10	203	2.80	398	3.50	645	4.40	1,030
1.50	86	2.20	227	2.90	430	3.60	684	4.60	1,120
1.60	102	2.30	253	3.00	463	3.70	724	4.80	1,220
1.70	120	2.40	280	3.10	498	3.80	765		

MARCH 24 TO OCTOBER 19, 1906.[b]

1.70	30	2.60	210	3.50	530	4.40	955	5.60	1,710
1.80	42	2.70	249	3.60	570	4.50	1,010	5.80	1,860
1.90	56	2.80	270	3.70	615	4.60	1,065	6.00	2,020
2.00	72	2.90	305	3.80	660	4.70	1,120	6.20	2,180
2.10	91	3.00	340	3.90	705	4.80	1,180	6.40	2,350
2.20	111	3.10	375	4.00	750	4.90	1,240	6.60	2,530
2.30	133	3.20	410	4.10	800	5.00	1,300		
2.40	157	3.30	450	4.20	850	5.20	1,430		
2.50	182	3.40	490	4.30	900	5.40	1,565		

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–5 and is fairly well defined.

[b] This table is applicable only for open-channel conditions. It is based on 4 discharge measurements made during 1906 and is not well defined.

Monthly discharge of Humboldt River at Palisade, Nev., for 1906.

[Drainage area, 5,010 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	120	120	120	7,380	0.024	0.03
February	180	120	129	7,160	.026	.03
March	1,500	203	827	50,800	.165	.19
April	2,620	1,500	1,960	117,000	.391	.44
May	2,260	1,000	1,450	89,200	.289	.33
June	2,020	1,430	1,740	104,000	.347	.39
July	1,430	340	1,060	65,200	.212	.24
August	305	30	90.9	5,420	.018	.02
September	42	26	30.7	1,830	.0061	.01
October (1-19)	42	30	41.4	1,500	.0083	.01
The period				450,000		

NOTE.—The open-channel rating table was applied throughout the year; values for winter months are liable to some error on account of ice.

HUMBOLDT RIVER NEAR GOLCONDA, NEV.

This station was established October 24, 1894. It is located 1¼ miles north of the town of Golconda, near the great northern bend of Humboldt River and below the central valley, and is about 12 miles above the mouth of Little Humboldt River. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 76, where are given also references to publications that contain data for previous years.

Discharge measurements of Humboldt River near Golconda, Nev., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 25	M. B. Kennedy	80	433	9.10	777
June 26	do	82	421	9.05	850
July 11	do	89	464	9.35	908
August 9	do	50	98	5.60	161

Daily gage height, in feet, of Humboldt River near Golconda, Nev., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1								6.4	4.2	3.7		4.1
2	2.7		6.2	8.6	10.8	8.8	9.8					
3		5.4	6.3						4.2	3.6	3.7	4.1
4	2.7	5.4		8.9		8.8	9.9	6.2				
5	2.7	5.4	6.2		10.7				4.1		3.7	4.1
6	2.7			9.1		8.9		6.1		3.6		
7		5.4	6.2	9.4	10.3		9.9				3.7	
8		5.4			10.2	9.0			4.1	3.5		4.1
9	2.7			9.6	10.0	9.0	9.8					
10	2.7		6.3						4.0	3.5	3.8	4.2
11	2.7			9.8	9.7	9.1	9.7	5.6				
12	3.0	5.2	6.6		9.6				3.9		3.8	4.2
13			6.4	10.0		9.1		5.4		3.5		
14		5.4	6.6	10.4	9.5		9.6				3.8	
15	3.0				9.5			5.2	3.7	3.5		4.7
16	3.0	5.6	6.5	10.6	9.4	9.1	9.1					
17	2.7	5.8	6.5						3.7	3.5	3.8	4.8
18	3.6			10.6	9.3	9.1	8.7	4.9				
19		6.0	6.6		9.3				3.7		3.8	4.8
20						9.1		5.8		3.5		
21		6.2	6.8	10.6	9.3		7.4				3.8	
22	3.0					9.1		4.7	3.8	3.5		4.8
23	3.6	6.4	7.0	10.6	9.2	9.0	7.2					
24	3.0		7.3		9.1				3.8	3.5	3.8	4.9
25	3.5			10.9		9.0	7.1	4.6				
26	3.9	5.9	7.5	10.9	9.0				3.7		3.9	5.0
27						10.0		4.5		3.5		
28		6.1	7.9	10.9	9.0		7.0				4.0	
29					9.0			4.4	3.7	3.6		5.0
30	5.4			10.9	8.9	9.7	6.8					
31			8.4		8.8		6.6			3.6		5.1

Rating table for Humboldt River near Golconda, Nev., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.70	0	3.70	17	4.70	77	5.70	171	7.40	420
2.80	0.2	3.80	21	4.80	85	5.80	182	7.60	460
2.90	.5	3.90	26	4.90	93	5.90	194	7.80	500
3.00	1	4.00	31	5.00	102	6.00	206	8.00	540
3.10	2	4.10	36	5.10	111	6.20	231	8.20	590
3.20	3	4.20	42	5.20	120	6.40	258	8.40	640
3.30	5	4.30	48	5.30	130	6.60	286	8.60	690
3.40	7	4.40	55	5.40	140	6.80	315	8.80	740
3.50	10	4.50	62	5.50	150	7.00	345	9.00	800
3.60	13	4.60	69	5.60	160	7.20	380	10.00	1,100

NOTE.—This table is applicable only for open-channel conditions. It is based on 4 discharge measurements made during 1906 and is fairly well defined above gage height 5 feet; below this it is only roughly approximate.

Monthly discharge of Humboldt River near Golconda, Nev., for 1906.

[Drainage area, 10,800 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	140	0	20.0	1,230	0.0019	0.002
February	258	120	172	9,550	.016	.02
March	640	231	324	19,900	.030	.03
April	1,420	690	1,160	69,000	.107	.12
May	1,400	740	1,000	61,500	.093	.11
June	1,100	740	836	49,700	.077	.09
July	1,070	286	704	43,300	.065	.07
August	258	55	131	8,060	.012	.01
September	42	17	26.2	1,560	.0024	.003
October	17	10	11.4	701	.0011	.001
November	31	17	21.2	1,260	.002	.002
December	111	36	69.1	4,250	.0064	.01
The year	1,420	0	73	270,000	.034	.47

NOTE.—In January, February, and May discharges were interpolated on days when gage was not read; for other months the mean discharge of days when gage was read was taken as the mean for the month. The open-channel rating was applied throughout the year; values for the winter months are liable to some error on account of ice.

HUMBOLDT RIVER NEAR OREANA, NEV.

This station was established January 27, 1896. It is located near Oreana, Nev., about 12 miles northeast of Lovelocks. The results of the observations at this locality show the amount of water available for storage at the possible reservoir sites in the vicinity of Humboldt station, and also for the six canal systems now in operation below Oreana. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 79, where are given also references to publications that contain data for previous years.

Discharge measurements of Humboldt River near Oreana, Nev., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 24	M. B. Kennedy	100	269	4.62	586
June 27	do	100	289	4.90	625
July 12	do	100	341	5.45	807
August 10	do	100	143	3.45	261

Daily gage height, in feet, of Humboldt River near Oreana, Nev., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.4	2.45	2.35	3.4	5.65	5.25	5.5	4.25	2.5	2.1	2.5	2.25
2	2.4	2.4	2.45	3.5	5.65	5.25	5.5	4.2	2.5	2.1	2.5	2.3
3	2.35	2.4	2.5	3.55	5.7	5.9	5.2	4.1	2.5	2.2	2.5	2.3
4	2.35	2.45	2.55	3.6	5.7	5.9	5.25	3.9	2.45	2.2	2.25	2.3
5	2.35	2.5	2.55	3.85	5.7	5.9	5.2	3.85	2.45	2.1	2.15	2.35
6	2.35	2.5	2.6	3.9	5.55	5.95	5.2	3.85	2.4	2.1	2.1	2.35
7	2.35	2.45	2.6	4.0	5.65	5.9	5.3	3.8	2.4	2.05	2.1	2.35
8	2.35	2.45	2.6	4.1	5.65	4.1	5.3	3.75	2.35	2.05	2.1	2.4
9	2.4	2.4	2.65	4.1	5.7	4.5	5.3	3.75	2.35	2.0	2.1	2.65
10	2.4	2.4	2.7	4.2	5.8	4.2	5.35	3.6	2.3	2.0	2.1	2.65
11	2.4	2.4	2.7	4.25	5.85	4.25	5.35	3.6	2.3	2.1	2.1	2.65
12	2.45	2.45	2.7	4.35	5.9	4.4	5.4	3.5	2.3	2.1	2.1	2.7
13	2.5	2.4	2.7	4.4	5.9	4.4	5.45	3.35	2.3	2.1	2.1	2.75
14	2.5	2.35	2.65	4.6	5.9	4.5	5.5	3.3	2.35	2.0	2.5	2.85
15	2.55	2.35	2.65	4.65	5.85	4.0	5.5	3.2	2.35	2.0	2.5	2.9
16	2.6	2.3	2.65	4.7	5.8	4.0	5.5	3.15	2.3	2.0	2.1	2.95
17	2.7	2.2	2.65	4.8	5.5	4.2	5.4	3.5	2.25	2.0	2.1	2.95
18	2.75	2.1	2.7	4.95	5.35	4.8	5.35	3.5	2.25	2.0	2.1	2.9
19	2.8	2.1	2.7	5.0	5.2	4.85	5.35	3.0	2.2	2.0	2.1	2.85
20	2.9	2.5	2.75	5.5	5.4	4.7	5.3	2.9	2.2	2.0	2.1	2.8
21	2.9	2.5	2.75	5.1	5.5	4.7	5.2	2.9	2.25	2.1	2.15	2.75
22	2.9	2.1	2.8	5.1	5.2	5.2	5.15	2.85	2.25	2.1	2.15	2.75
23	2.9	2.1	2.85	5.15	4.9	5.4	5.1	2.7	2.2	2.1	2.15	2.7
24	2.85	2.15	2.9	5.2	4.5	5.1	5.1	2.7	2.15	2.5	2.1	2.7
25	2.85	2.15	2.95	5.25	4.55	5.1	5.0	2.6	2.2	2.0	2.35	2.65
26	2.75	2.2	3.5	5.35	4.5	5.5	4.8	2.6	2.2	2.0	2.3	2.55
27	2.7	2.2	3.2	5.4	4.8	4.5	4.55	2.65	2.1	2.0	2.3	2.5
28	2.6	2.3	3.2	5.5	5.1	4.1	4.35	2.6	2.1	2.5	2.3	2.45
29	2.4	.....	3.25	5.6	5.4	4.0	4.35	2.55	2.95	2.5	2.3	2.45
30	2.4	.....	3.25	5.65	5.3	3.9	4.3	2.55	2.5	2.5	2.25	2.45
31	2.45	.....	3.3	.....	5.3	.....	4.3	2.5	.....	2.5	.....	2.45

NOTE.—There was probably no material obstruction by ice during 1906.

Rating tables for Humboldt River near Oreana, Nev.

JANUARY 1, 1905, TO APRIL 6, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.10	0	1.70	12	2.30	82	2.90	193	3.50	335
1.20	0.5	1.80	20	2.40	98	3.00	215	3.60	360
1.30	1	1.90	29	2.50	115	3.10	238	3.70	385
1.40	2	2.00	40	2.60	133	3.20	261	3.80	412
1.50	3.5	2.10	53	2.70	152	3.30	285	3.90	440
1.60	7	2.20	67	2.80	172	3.40	310		

APRIL 7 TO DECEMBER 31, 1906.[b]

2.00	16	2.80	124	3.60	296	4.40	500	5.40	820
2.10	26	2.90	143	3.70	320	4.50	530	5.60	890
2.20	37	3.00	163	3.80	345	4.60	560	5.80	960
2.30	49	3.10	183	3.90	370	4.70	590	6.00	1,030
2.40	62	3.20	204	4.00	395	4.80	620		
2.50	75	3.30	226	4.10	420	4.90	650		
2.60	90	3.40	249	4.20	445	5.00	680		
2.70	106	3.50	272	4.30	470	5.20	750		

[a] This table is applicable only for open-channel conditions. It is based on 6 discharge measurements made during 1905 and is fairly well defined between gage heights 1.6 feet and 3.0 feet.

[b] This table is applicable only for open-channel conditions. It is based on 4 discharge measurements made during 1906 and the form of the 1905 curve and is well defined above gage height 3 feet. Below gage height 3 feet it is uncertain.

Monthly discharge of Humboldt River near Oreana, Nev., for 1906.

[Drainage area, 13,800 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	193	90	129	7,930	0.0094	0.01
February	115	53	87.7	4,870	.0064	.007
March	335	90	172	10,600	.012	.01
April	908	310	595	35,400	.043	.05
May	995	530	835	51,300	.060	.07
June	1,010	370	638	38,000	.046	.05
July	855	470	735	45,200	.053	.06
August	458	75	229	14,100	.017	.02
September	153	26	54.1	3,220	.0039	.004
October	75	16	30.4	1,870	.0022	.003
November	75	26	40.2	2,390	.0029	.003
December	153	43	93.2	5,730	.0068	.008
The year	1,010	16	303	221,000	.022	.30

NOTE.—The open-channel rating table was applied throughout the year; values for the winter months are liable to some error on account of ice.

SIERRA NEVADA DRAINAGE.

PRINCIPAL STREAMS.

The Sierra Nevada drainage area includes the western part of Nevada, the eastern part of California, and a small part of south-central Oregon. The principal rivers of the area, with the bodies of water into which they discharge, are the following: Truckee River into Pyramid and Winnemucca lakes, Walker River into Walker Lake, Carson River into Carson Sink, Susan River into Honey Lake, and Owens River into Owens Lake.

TRUCKEE RIVER BASIN.

DESCRIPTION OF BASIN.

Upper Truckee River rises on the eastern slopes of the Sierra Nevada, in Eldorado County, Cal., and flows northward, entering Lake Tahoe from the south. The main Truckee leaves the lake, of which it forms the outlet, at the town of Tahoe, in eastern Placer County, Cal., flows north and northeast, and discharges, in Washoe County, Nev., into Pyramid and Winnemucca lakes, which have no outflowing streams. The drainage basin is wild and mountainous, the highest peaks reaching altitudes exceeding 10,000 feet. Lake Tahoe, which lies at an elevation of 6,225 feet above sea, has an area of 193 square miles and is the largest body of fresh water in the United States at this altitude.

In the lower part of its course the Truckee receives several important tributaries, among which may be mentioned Donner and Prosser creeks and Little Truckee River, the latter uniting with the main stream at the town of Boca. Independence Creek is a branch of the Little Truckee.

TRUCKEE RIVER AT TAHOE, CAL.

This station was established June 17, 1900, with a view to ascertaining the actual overflow from Lake Tahoe and the real value of the lake as a storage reservoir. It is located at the city of Tahoe. About 500 feet from the lake there is a timber dam across the river, which has been maintained for more than twenty years for the purpose of controlling the discharge from the lake. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 88, where are given also references to publications that contain data for previous years.

Discharge measurements of Truckee River at Tahoe, Cal., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
July 2	M. B. Kennedy	75	317	2.90	785
August 4	do	74	203	2.50	552

Daily gage height, in feet, of Truckee River at Tahoe, Cal., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.4	2.0	2.1	2.25	2.4	2.45	2.9	3.0	3.2	2.0	2.95	2.7
2	1.4	2.0	2.1	2.25	2.4	2.45	2.9	3.0	3.2	2.8	2.95	2.7
3	1.4	2.0	2.1	2.25	2.4	2.45	2.9	3.0	3.2	2.7	2.95	2.7
4	1.4	2.0	2.1	2.25	2.4	2.45	2.9	.....	3.2	2.7	2.95	2.7
5	1.4	2.0	2.1	2.3	2.4	2.45	2.9	2.55	3.2	2.7	2.95	2.7
6	1.4	2.0	2.1	2.3	2.4	2.45	2.9	2.55	3.2	2.7	2.95	2.7
7	1.4	2.0	2.1	2.3	2.5	2.45	2.9	2.55	3.2	2.8	2.95	2.6
8	1.4	2.0	2.1	2.3	2.28	2.45	2.9	2.55	3.2	2.8	2.95	2.6
9	1.4	1.95	2.1	2.3	2.28	2.85	2.9	2.55	3.2	2.8	2.95	2.6
10	1.4	1.95	2.1	2.3	2.6	2.85	3.0	3.1	3.2	3.2	2.95	2.7
11	1.4	1.95	2.1	2.3	2.6	2.45	3.0	3.1	3.2	3.2	2.95	2.7
12	1.4	1.95	2.2	2.3	2.6	2.7	3.0	3.1	3.2	3.2	2.95	2.7
13	1.5	1.95	2.2	2.3	2.6	2.7	3.0	3.1	3.2	3.2	2.95	2.7
14	1.5	1.95	2.2	2.3	2.6	2.6	3.0	3.1	3.2	3.2	2.95	2.7
15	1.6	2.0	2.2	2.3	2.65	2.6	3.0	3.1	2.95	3.2	2.95	2.9
16	1.6	2.0	2.2	2.3	2.65	2.6	3.0	3.1	2.95	3.2	2.95	2.9
17	1.7	2.0	2.2	2.3	2.7	2.6	3.0	3.1	2.95	3.2	2.9	2.9
18	1.8	2.0	2.2	2.3	2.7	2.6	3.0	3.25	2.95	3.2	2.9	2.9
19	1.8	2.0	2.2	2.3	2.7	2.6	3.0	3.25	2.95	3.2	2.9	2.9
20	1.9	2.0	2.2	2.3	2.7	2.6	3.0	3.25	2.95	3.1	2.9	2.8
21	1.9	2.0	2.2	2.3	2.7	2.6	3.0	3.25	2.95	3.1	2.85	2.8
22	2.0	2.1	2.2	2.35	2.75	2.6	3.0	3.25	2.95	3.1	2.85	2.8
23	2.0	2.1	2.2	2.35	2.75	2.6	3.0	3.2	2.95	3.1	2.85	2.8
24	2.0	2.1	2.2	2.35	2.75	2.6	3.0	3.2	2.9	2.95	2.85	2.8
25	2.0	2.1	2.2	2.35	2.4	2.6	3.0	3.2	2.9	2.95	2.85	2.8
26	2.0	2.1	2.2	2.35	2.15	2.6	3.0	3.2	2.9	2.95	2.85	2.8
27	2.0	2.1	2.2	2.35	2.0	2.9	3.0	3.2	2.9	2.95	2.75	2.8
28	2.0	2.1	2.2	2.35	2.0	2.9	3.0	3.2	2.9	2.95	2.75	2.8
29	2.0	.....	2.2	2.35	2.0	2.9	3.0	3.18	2.9	2.95	2.75	2.85
30	2.0	.....	2.2	2.35	2.0	2.9	3.0	3.18	2.9	2.95	2.7	2.85
31	2.0	.....	2.25	.....	2.45	.....	3.0	3.18	.....	2.95	.....	2.9

Rating table for Truckee River at Tahoe, Cal., for 1905–6.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.30	15	1.00	139	1.70	306	2.40	518	3.10	776
.40	31	1.10	160	1.80	334	2.50	552	3.20	817
.50	47	1.20	182	1.90	363	2.60	586	3.30	859
.60	64	1.30	205	2.00	392	2.70	622		
.70	82	1.40	229	2.10	422	2.80	659		
.80	100	1.50	253	2.20	453	2.90	697		
.90	119	1.60	279	2.30	485	3.00	736		

NOTE. This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905–6 and the for n of previous curves, and is not well defined.

Monthly discharge of Truckee River near Tahoe, Cal., for 1906.

[Drainage area 519 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	392	229	304	18,700	0.586	0.68
February	422	378	396	22,000	.763	.79
March	469	422	443	27,200	.854	.98
April	502	469	488	29,000	.940	1.05
May	640	392	543	33,400	1.05	1.21
June	697	535	594	35,300	1.14	1.27
July	736	697	725	44,000	1.40	1.61
August	838	552	753	46,300	1.45	1.67
September	817	697	759	45,200	1.46	1.63
October	817	392	726	44,600	1.40	1.61
November	716	622	695	41,400	1.34	1.50
December	697	586	647	39,800	1.25	1.44
The year	838	229	589	428,000	1.14	15.44

NOTE.—The open-channel rating table was applied throughout the year; values for winter months are liable to some error on account of ice.

TRUCKEE RIVER AT NEVADA-CALIFORNIA STATE LINE.

This station was established September 7, 1899. It is located at the State line, 17 miles west of Reno, Nev. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 86, where are given also references to publications that contain data for previous years.

Discharge measurements of Truckee River at Nevada-California State line in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 24	C. L. Smith	72	304	2.50	759
May 23	M. B. Kennedy	90	544	4.60	2,480
June 21	do	90	648	5.30	3,140
July 3	do	90	613	4.95	2,710
July 30	do	73	334	3.10	1,000

Daily gage height, in feet, of Truckee River at Nevada-California State line for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.80	2.30	2.70	3.58	5.92	4.00	4.85	2.85	2.75	2.35	2.75	2.50
2	1.80	2.28	2.65	3.48	6.85	4.25	4.98	2.90	2.75	2.38	2.65	2.48
3	1.80	2.30	2.62	3.22	6.85	4.65	5.00	2.90	2.62	2.50	2.65	2.48
4	1.72	2.28	2.58	3.08	6.82	5.08	4.90	2.85	2.60	2.50	2.98	2 52
5	1.72	2.25	2.52	3.00	7.15	5.05	4.95	2.65	2.65	2.48	2.78	2.50
6	1.75	2.35	2.50	3.35	7.08	4.65	4.98	2.60	2.68	2.48	2.70	2.45
7	1.75	2.35	2.50	3.50	7.18	4.45	4.60	2.65	2.65	2.50	2.68	2.45
8	1.85	2.30	2.55	3.90	7.15	4.30	4.68	2.60	2.65	2.50	2.65	2.48
9	1.95	2.30	2.60	4.20	7.18	4.88	4.50	2.65	2.65	2.50	2.68	2.45
10	2.00	2.30	2.72	4.22	6.85	5.25	4.25	2.70	2.65	2.58	2.68	2.68
11	1.95	2.30	2.85	3.98	6.98	6.25	4.20	2.80	2.65	2.75	2.70	2.60
12	1.98	2.48	3.72	4.00	6.60	5.90	4.20	2.85	2.65	2.65	2.65	2.62
13	2.00	2.40	3.05	4.10	6.35	5.20	4.22	2.90	2.65	2.72	2.70	2.65
14	1.98	2.38	2.78	4.28	6.40	5.05	4.20	2.80	2.65	2.75	2.68	2.65
15	2.05	2.52	2.82	4.55	6.25	5.10	4.00	2.80	2.65	2.68	2.70	2.65
16	2.18	2.52	2.80	6.95	5.88	5.55	3.88	2.80	2.68	2.65	2.70	2.60
17	2.22	2.52	2.80	6.00	5.68	5.55	3.70	2.70	2.65	2.65	2.65	2.58
18	2.90	2.55	2.78	5.98	5.25	5.02	3.42	2.80	2.65	2.65	2.65	2.60
19	3.18	2.85	2.82	6.08	4.80	5.22	3.60	2.75	2.62	2.65	2.60	2.60
20	2.80	2.90	2.78	6.05	4.88	5.32	3.50	2.85	2.65	2.62	2.55	2.60
21	2.68	2.70	2.85	6.60	4.70	5.50	3.45	2.80	2.62	2.65	2.60	2.60
22	2.68	2.72	3.15	6.80	4.73	5.35	3.40	2.85	2.60	2.52	2.50	2.60
23	2.62	2.70	3.25	6.75	4.62	5.20	3.40	2.78	2.65	2.52	2.58	2.60
24	2.58	2.70	3.45	5.90	4.40	5.20	3.35	2.78	2.65	2.60	2.50	2.62
25	2.52	2.68	3.52	5.70	4.40	5.02	3.35	2.75	2.65	2.60	2.50	2.68
26	2.50	2.68	3.50	5.88	4.82	4.92	3.68	2.75	2.62	2.62	2.55	2.98
27	2.50	2.68	3.40	5.82	4.55	4.90	3.30	2.75	2.62	2.70	2.50	2.92
28	2.48	2.70	3.48	4.70	4.20	4.45	3.30	2.80	2.62	2.45	2.45	2.85
29	2.42	.....	3.40	4.35	4.02	4.28	3.15	2.80	2.60	2.42	2.52	2.80
30	2.35	.....	3.45	4.80	3.92	4.20	3.05	2.80	2.60	2.55	2.52	2.78
31	2.20	.....	3.90	.....	3.80	.....	3.00	2.75	.....	2.62	.....	2.75

Rating tables for Truckee River at Nevada-California State line.

JANUARY 1, 1905, to APRIL 15, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.70	300	2.60	810	3.50	1,580	4.40	2,470	5.60	3,850
1.80	346	2.75	884	3.60	1,676	4.50	2,580	5.80	4,090
1.90	394	2.80	961	3.70	1,772	4.60	2,690	6.00	4,330
2.00	444	2.90	1,042	3.80	1,870	4.70	2,800	6.20	4,570
2.10	496	3.00	1,126	3.90	1,970	4.80	2,910	6.40	4,810
2.20	551	3.10	1,213	4.00	2,070	4.90	3,020		
2.30	610	3.20	1,302	4.10	2,170	5.00	3,130		
2.40	673	3.30	1,393	4.20	2,270	5.20	3,370		
2.50	740	3.40	1,486	4.30	2,370	5.40	3,610		

APRIL 16 TO DECEMBER 31, 1906.[b]

2.30	460	3.10	995	3.90	1,700	4.70	2,500	6.00	3,950
2.40	520	3.20	1,075	4.00	1,800	4.80	2,600	6.20	4,190
2.50	580	3.30	1,155	4.10	1,900	4.90	2,710	6.40	4,430
2.60	645	3.40	1,240	4.20	2,000	5.00	2,820	6.60	4,670
2.70	710	3.50	1,325	4.30	2,100	5.20	3,040	6.80	4,920
2.80	780	3.60	1,415	4.40	2,200	5.40	3,260	7.00	5,180
2.90	850	3.70	1,510	4.50	2,300	5.60	3,480	7.20	5,440
3.00	920	3.80	1,605	4.60	2,400	5.80	3,710		

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1906 and is well defined.

[b] This table is applicable only for open-channel conditions. It is based on 4 discharge measurements made during 1906 and the form of the previous curve, and is fairly well defined above gage heights 3 feet.

Monthly discharge of Truckee River at Nevada-California State line for 1906.

[Drainage area, 955 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	1,290	309	592	36,400	0.620	0.71
February	1,040	580	746	41,400	.781	.81
March	1,970	740	1,130	69,500	1.18	1.36
April	5,120	1,130	2,850	170,000	2.98	3.32
May	5,410	1,600	3,650	224,000	3.82	4.40
June	4,250	1,800	2,830	168,000	2.96	3.30
July	2,820	920	1,800	111,000	1.88	2.17
August	850	645	763	46,900	.799	.92
September	745	645	675	40,200	.707	.79
October	745	490	629	38,700	.659	.76
November	906	550	670	39,900	.702	.78
December	906	550	662	40,700	.693	.80
The year	5,410	309	1,420	1,030,000	1.48	20.12

NOTE.—The open-channel rating tables were applied throughout the year; values for the winter months are liable to some error on account of ice.

DONNER CREEK NEAR TRUCKEE, CAL.

Donner Creek flows from the east end of Donner Lake eastward into Truckee River.

The gaging station was established October 23, 1902. It is located about 150 feet below the dam of the Donner Creek Ice Company and 1½ miles west of Truckee, Cal. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 97, where are given also references to publications that contain data for previous years.

Discharge measurements of Donner Creek near Truckee, Cal., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 31	M. B. Kennedy	36	76	3.40	323
June 29	do	37	81	3.60	330
August 1	do	17	18	1.65	35

Daily gage height, in feet, of Donner Creek near Truckee, Cal., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.9	1.9	2.05	2.6	3.55	3.55	3.95	1.75	1.2	1.2	1.0	1.1
2	1.9	1.9	2.0	2.6	3.65	3.65	4.0	1.65	1.2	1.2	1.0	1.1
3	1.9	1.9	2.0	2.65	3.8	3.85	4.0	1.6	1.1	1.2	1.0	1.1
4	1.9	1.9	2.0	2.7	4.25	4.1	4.0	1.55	1.1	1.2	1.45	1.1
5	1.9	1.9	2.05	2.7	4.55	4.1	3.85	1.5	1.1	1.2	1.45	1.1
6	1.9	1.9	2.1	2.75	4.6	4.0	3.8	1.5	1.1	1.2	1.35	1.1
7	1.9	1.9	2.1	2.8	4.6	4.0	3.7	1.5	1.1	1.2	1.25	1.15
8	1.9	1.9	2.1	2.8	4.6	4.05	3.7	1.5	1.1	1.2	1.2	1.25
9	1.9	1.9	2.1	2.8	4.55	4.15	3.6	1.5	1.1	1.2	1.2	1.35
10	2.0	1.9	2.2	2.8	4.3	4.2	3.45	1.45	1.1	1.2	1.2	1.5
11	2.0	1.9	2.2	2.85	4.2	4.5	3.3	1.4	1.1	1.2	1.2	1.55
12	2.0	1.9	2.3	2.9	4.1	4.7	3.4	1.4	1.1	1.2	1.2	1.5
13	3.75	1.9	2.3	2.95	4.15	4.5	3.45	1.4	1.1	1.2	1.2	1.4
14	2.0	1.9	2.3	3.0	4.15	4.1	3.3	1.4	1.1	1.2	1.2	1.4
15	1.95	1.95	2.3	3.05	4.0	4.1	3.3	1.35	1.1	1.2	1.35	1.4
16	1.8	2.0	2.3	3.1	3.9	4.4	3.3	1.3	1.1	1.2	1.55	1.3
17	1.95	2.0	2.3	3.15	3.8	4.25	3.3	1.3	1.1	1.2	1.4	1.3
18	2.05	2.1	2.3	3.25	3.95	4.05	3.3	1.25	1.15	1.2	1.3	1.3
19	2.2	2.35	2.35	3.3	4.2	4.05	3.3	1.2	1.2	.....	1.3	1.2
20	2.2	2.25	2.4	3.35	4.5	4.25	3.2	1.2	1.2	.....	1.25	1.2
21	2.2	2.2	2.45	3.55	4.75	4.3	3.2	1.2	1.2	.....	1.2	1.2
22	2.15	2.2	2.5	3.6	4.65	4.2	3.1	1.2	1.2	.....	1.2	1.2
23	2.05	2.2	2.5	3.55	4.55	4.25	2.95	1.2	1.2	.....	1.2	1.35
24	2.05	2.2	2.5	3.4	4.3	4.2	2.7	1.2	1.2	.....	1.2	1.45
25	2.05	2.2	2.5	3.25	4.05	4.15	2.45	1.2	1.2	1.0	1.2	1.55
26	2.1	2.2	2.5	3.2	4.05	3.95	2.25	1.2	1.2	1.0	1.2	1.75
27	2.1	2.2	2.5	3.2	3.85	3.8	2.15	1.2	1.2	1.0	1.2	1.55
28	2.05	2.1	2.5	3.2	3.75	3.85	2.05	1.2	1.2	1.0	1.1	1.4
29	2.0	.....	2.55	3.2	3.7	3.9	2.0	1.2	1.2	1.0	1.1	1.3
30	2.0	.....	2.6	3.2	3.7	3.95	1.9	1.2	1.2	1.0	1.1	1.3
31	2.0	.....	2.6	.....	3.55	.....	1.85	1.2	.....	1.0	.....	1.3

NOTE.—The ice ponds were being filled October 19 to 24, and there was practically no flow at the station

Rating tables for Donner Creek near Truckee, Cal.

JANUARY 1, 1905, TO APRIL 30, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.70	0.0	1.40	5.7	2.00	29	2.60	86	3.20	185
.80	0.1	1.50	8.3	2.10	35	2.70	100	3.30	206
.90	.2	1.60	11.5	2.20	43	2.80	115	3.40	227
1.00	.5	1.70	15	2.30	52	2.90	131	3.50	248
1.10	1.1	1.80	19	2.40	62	3.00	148	3.60	269
1.20	2.0	1.90	24	2.50	73	3.10	166	3.70	290
1.30	3.5								

MAY 1 TO DECEMBER 31, 1906.[b]

1.00	9	1.80	45	2.60	142	3.40	307	4.20	520
1.10	12	1.90	53	2.70	159	3.50	330	4.30	550
1.20	15	2.00	62	2.80	177	3.60	354	4.40	580
1.30	19	2.10	72	2.90	196	3.70	379	4.50	610
1.40	23	2.20	84	3.00	217	3.80	405	4.60	645
1.50	27	2.30	97	3.10	239	3.90	432	4.70	680
1.60	32	2.40	111	3.20	261	4.00	460	4.80	715
1.70	38	2.50	126	3.30	284	4.10	490		

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–5 and is well defined.

[b] This table is applicable only for open-channel conditions. It is based on 3 discharge measurements made during 1906 and the form of the 1905 curve and is not well defined.

Monthly discharge of Donner Creek near Truckee, Cal., for 1906.

[Drainage area, 30 square miles.]

Month.	Discharge in second-feet.			Total in acre feet.	Run off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	300	19	38.3	2,360	1.28	1.48
February	57	24	32.0	1,780	1.07	1.11
March	86	29	54.5	3,350	1.82	2.10
April	269	86	161	9,580	5.37	5.99
May	698	342	506	31,100	16.87	19.45
June	680	342	493	29,300	16.43	18.33
July	460	49	269	16,500	8.97	10.34
August	42	15	21.4	1,320	.713	.82
September	15	12	13.5	803	.450	.50
October[a]	15	0	11.1	682	.370	.43
November	30	9	16.3	970	.543	.61
December	42	12	20.0	1,230	.667	.77
The year	698	0	136	99,000	4.55	61.93

[a] Mean discharge estimated 7 second-feet October 19, and 5 second-feet October 24.

NOTE.—The open-channel rating was applied throughout the year; values for the winter months are liable to some error on account of ice.

TRUCKEE RIVER AT VISTA, NEV.

This station was established August 18, 1899. It is located 7 miles east of Reno, Nev., and one-fourth mile from the Southern Pacific Railroad station at Vista. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 84, where are given also references to publications that contain data for previous years.

Discharge measurements of Truckee River at Vista, Nev., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
January 25	C. L. Smith	113	485	5.40	896
May 22	M. B. Kennedy	120	796	8.10	3,150
July 19	do	119	862	8.50	3,290
July 5	do	120	890	8.20	3,570
July 28	do	115	[illegible]	6.00	1,320

Daily gage height, in feet, of Truckee River at Vista, Nev., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.0	4.8	5.0	6.7	8.2	6.8	7.8	5.4	4.9	4.7	5.2	4.9
2	4.0	4.8	5.0	6.6	8.9	7.3	8.0	5.0	4.8	4.3	5.2	4.9
3	3.9	4.8	5.0	6.3	9.4	7.3	8.0	5.1	4.8	4.6	5.1	4.9
4	4.0	4.7	5.0	5.9	9.4	8.0	8.3	5.0	4.7	4.6	5.4	4.8
5	4.0	4.7	5.0	5.7	9.7	8.4	8.3	4.7	4.7	4.6	5.8	4.9
6	4.0	4.7	5.0	6.0	9.8	8.0	8.2	4.6	4.8	4.6	5.3	4.9
7	4.0	4.7	5.0	6.5	9.9	7.4	8.0	4.5	4.7	4.7	5.2	4.9
8	4.0	4.7	5.1	7.0	9.9	7.3	8.0	4.6	4.7	4.7	5.2	5.1
9	4.1	4.7	5.2	7.4	9.8	7.7	7.8	4.6	4.7	4.7	5.2	5.0
10	4.1	4.7	5.2	7.7	9.7	8.0	7.5	4.6	4.7	4.7	5.2	5.0
11	4.2	4.7	5.4	7.4	9.6	8.5	7.3	5.0	4.7	4.9	5.2	5.7
12	4.5	4.8	5.9	7.3	9.8	9.2	7.2	4.9	4.7	5.0	5.2	5.9
13	5.4	4.8	6.0	7.4	9.6	9.0	7.2	4.9	4.7	5.0	5.2	5.5
14	5.8	4.8	5.8	7.4	9.6	8.7	7.2	4.9	4.7	5.2	5.2	5.3
15	5.0	5.0	5.4	8.0	9.3	8.6	7.2	4.8	4.9	5.0	5.2	5.3
16	5.4	5.0	5.4	8.4	8.8	8.6	7.0	4.8	4.9	5.0	5.3	5.2
17	5.7	5.0	5.4	8.6	8.0	8.9	6.5	4.8	4.9	5.0	5.2	5.2
18	7.6	5.0	5.4	8.6	8.0	8.6	6.5	4.7	4.9	5.0	5.1	5.2
19	7.5	5.0	5.4	8.6	7.8	8.6	6.2	4.7	4.8	4.9	5.0	5.2
20	6.5	5.2	5.4	8.7	8.0	8.6	6.0	4.7	4.8	4.9	5.0	5.2
21	5.6	5.4	5.3	8.9	8.0	8.6	6.0	4.9	4.8	5.0	5.0	5.1
22	5.3	5.4	5.6	9.2	8.0	8.6	5.9	4.8	4.7	5.0	5.0	5.1
23	5.4	5.4	6.0	9.3	7.6	8.6	5.8	4.8	5.2	5.0	5.0	5.2
24	5.2	5.2	6.4	9.0	7.5	8.4	6.0	4.7	4.9	5.0	5.0	5.2
25	5.1	5.1	6.7	8.6	7.3	8.4	6.0	4.7	4.8	5.0	5.0	5.3
26	5.0	5.1	6.5	8.0	8.0	8.4	6.3	4.7	4.8	5.0	5.0	5.7
27	5.0	5.1	6.3	7.9	7.4	8.3	6.5	4.8	5.0	5.2	5.0	5.7
28	5.0	5.0	6.3	7.7	7.4	7.8	6.0	4.8	4.7	5.2	5.0	5.6
29	4.9	.....	6.3	7.7	7.2	7.7	5.9	4.8	4.7	4.5	4.9	5.6
30	4.9	.....	6.3	7.8	7.0	7.5	5.7	4.8	4.7	4.9	4.9	5.3
31	4.8	.....	7.1	.....	6.8	.....	5.6	4.9	.....	5.2	.....	5.3

Rating table for Truckee River at Vista, Nev., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.90	325	4.90	775	5.90	1,345	6.90	2,080	8.80	4,080
4.00	365	5.00	825	6.00	1,410	7.00	2,170	9.00	4,320
4.10	405	5.10	875	6.10	1,475	7.20	2,350	9.20	4,500
4.20	445	5.20	930	6.20	1,540	7.40	2,540	9.40	4,820
4.30	490	5.30	985	6.30	1,610	7.60	2,740	9.60	5,080
4.40	535	5.40	1,040	6.40	1,680	7.80	2,940	9.80	5,340
4.50	580	5.50	1,100	6.50	1,755	8.00	3,160	10.00	5,600
4.60	625	5.60	1,160	6.60	1,830	8.20	3,380		
4.70	675	5.70	1,220	6.70	1,910	8.40	3,600		
4.80	725	5.80	1,280	6.80	1,990	8.60	3,840		

NOTE.—This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–1906 and is well defined below gage height 8 feet.

Monthly discharge of Truckee River at Vista, Nev., for 1906.

[Drainage area, 1,520 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	2,740	325	871	53,600	0.573	0.66
February	1,040	675	797	44,300	.524	.55
March	2,200	825	1,210	74,400	.796	.92
April	4,690	1,220	2,910	173,000	1.91	2.13
May	5,470	1,990	3,870	238,000	2.55	2.94
June	4,500	1,990	3,400	202,000	2.24	2.50
July	3,490	1,160	2,170	133,000	1.43	1.65
August	1,040	580	729	44,800	.480	.55
September	930	675	722	43,000	.475	.53
October	930	490	763	46,900	.502	.58
November	1,280	775	900	53,600	.592	.66
December	1,340	725	952	58,500	.626	.72
The year	5,470	325	1,610	1,170,000	1.06	14.39

NOTE.—The open-channel rating table was applied throughout the year; values for the winter months are liable to some error on account of ice.

LITTLE TRUCKEE RIVER AT PINE STATION, CAL.

Little Truckee River rises on the eastern slope of the Sierra Nevada Mountains, in northwestern Nevada County, Cal., flows north, then east, and then south, and unites with the Truckee at the town of Boca, Cal.

The station was established June 25, 1903. The cable station is located about one-fourth mile upstream from Bruhn's mill, known also as Pine station. The road which follows the Little Truckee north from Boca crosses the river at a ford about 150 feet below the cable and the same distance above the gage rod. Pine station, on the Boca and Loyalton Railroad, about one-fourth of a mile distant, is the nearest railroad point. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 92, where are given also references to publications that contain data for previous years.

Discharge measurements of Little Truckee River at Pine station, Cal., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. feet.*	*Feet.*	*Sec.-feet.*
May 30	M. B. Kennedy	80	158	2.35	545
June 18	do	71	208	2.90	822
July 7	do	73	208	2.80	888
August 2	do	60	77	1.30	153

Daily gage height, in feet, of Little Truckee River at Pine station, Cal., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.30	1.68	1.05	1.92	3.06	2.45	2.74	1.32	0.78	0.70	0.82	0.90
2	1.23	1.55	1.10	1.82	3.62	2.50	2.78	1.28	.75	.70	.79	.94
3	1.28	1.60	1.12	1.73	3.55	2.64	2.85	1.22	.73	.68	.90	.92
4	1.30	1.48	1.10	1.68	3.59	3.04	2.86	1.18	.73	.68	1.32	.83
5	1.28	1.43	1.05	1.70	3.64	3.15	2.88	1.12	.73	.66	1.08	.78
6	1.28	1.45	1.05	1.85	3.64	2.92	2.82	1.10	.73	.68	.96	.92
7	1.23	1.43	1.06	2.09	3.66	2.72	2.78	1.05	.73	.68	.92	.92
8	1.18	1.40	1.12	2.30	3.62	2.82	2.75	1.04	.72	.68	.90	.88
9	1.30	1.50	1.15	2.52	3.59	3.19	2.65	1.03	.70	.65	.88	.92
10	1.30	1.43	1.22	2.49	3.56	3.49	2.50	1.12	.70	.65	.89	.98
11	1.30	1.48	1.30	2.39	3.69	3.44	2.26	1.06	.72	.65	.89	.68
12	1.30	1.40	1.40	2.40	3.42	3.69	2.26	1.02	.72	.66	.88	.90
13	1.38	1.33	2.39	2.49	3.25	3.36	2.34	.99	.72	.65	.88	1.29
14	1.50	1.30	1.20	2.60	3.21	3.19	2.32	.99	.74	.65	.88	1.32
15	1.60	1.20	1.18	2.90	3.09	3.09	2.18	.98	.75	.65	.88	1.26
16	1.83	1.39	1.30	3.02	2.80	3.45	2.19	.95	.74	.65	.90	1.24
17	2.10	1.35	1.30	3.02	2.66	3.36	2.00	.93	.73	.65	.89	1.38
18	2.98	1.28	1.30	3.14	2.74	3.01	1.94	.90	.70	.65	.88	1.24
19	3.33	1.20	1.30	3.29	2.89	3.31	1.86	.89	.70	.66	.75	1.16
20	3.20	1.33	1.19	3.42	2.94	3.21	1.80	.90	.76	.66	.88	1.05
21	3.03	1.40	1.28	3.55	2.84	3.23	1.74	.90	.69	.92	.82	1.10
22	2.83	1.38	1.48	3.62	2.81	3.25	1.55	.85	.68	.96	.83	1.12
23	2.75	1.20	1.53	3.42	2.64	3.21	1.56	.83	.68	1.00	.85	1.05
24	2.60	1.14	1.66	3.10	2.59	3.01	1.68	.82	.68	.95	.85	1.03
25	2.58	1.10	1.79	2.98	2.70	3.08	1.75	.80	.68	.94	.86	1.16
26	2.38	1.10	1.80	2.96	2.84	2.95	1.72	.80	.68	.90	.83	1.40
27	2.15	1.10	1.79	2.90	2.78	2.87	1.55	.79	.70	.86	.88	1.25
28	1.98	1.16	1.79	2.76	2.58	2.59	1.44	.78	.70	.82	.84	1.18
29	1.90	.....	1.79	2.92	2.42	2.44	1.38	.78	.70	.78	.90	1.02
30	1.83	.....	2.02	3.10	2.34	2.54	1.32	.80	.68	.78	.89	.99
31	1.80	.....	2.06	.....	2.43	.....	1.30	.80	.....	.79	.....	1.21

Rating tables for Little Truckee River at Pine station, Cal.,

JANUARY 1, 1905, to APRIL 14, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.00	78	1.40	148	1.80	270	2.10	390	2.40	531
1.10	91	1.50	174	1.90	307	2.20	436	2.50	580
1.20	107	1.60	203	2.00	347	2.30	483	2.60	630
1.30	126	1.70	235						

APRIL 15 to DECEMBER 31, 1906.[b]

0.70	55	1.40	178	2.00	395	2.60	695	3.20	1,040
.80	67	1.50	206	2.10	440	2.70	750	3.30	1,100
.90	80	1.60	237	2.20	490	2.80	805	3.40	1,160
1.00	94	1.70	271	2.30	540	2.90	860	3.50	1,225
1.10	110	1.80	309	2.40	590	3.00	920	3.60	1,290
1.20	129	1.90	351	2.50	640	3.10	980	3.70	1,355
1.30	152								

[a] This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–5 and is well defined below gage height 2.1 feet. The table has been extended beyond these limits.

[b] This table is applicable only for open-channel conditions. It is based on 4 discharge measurements made during 1906 and the form of the 1905 curve and is not well defined.

Monthly discharge of Little Truckee River at Pine Station, Cal., for 1906.

[Drainage area, 166 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	1,020	104	359	22,100	2.16	2.49
February	229	91	141	7,830	.849	.88
March	373	84	159	9,780	.958	1.10
April	1,300	229	729	43,400	4.39	4.90
May	1,350	590	972	59,800	5.86	6.76
June	1,350	610	950	56,500	5.72	6.38
July	849	152	478	29,400	2.88	3.32
August	157	65	91.9	5,650	.554	.64
September	65	53	56.7	3,370	.342	.38
October	94	50	60.9	3,740	.367	.42
November	157	66	79.7	4,740	.480	.54
December	178	65	103	6,330	.608	.71
The year	1,350	50	348	253,000	2.10	28.52

NOTE.—The open-channel rating table was applied throughout the year; values for the winter months are liable to some errors on account of ice.

INDEPENDENCE CREEK BELOW INDEPENDENCE LAKE, CAL.

Independence Creek flows from the east end of Independence Lake northeastward into Little Truckee River.

The gaging station was established October 24, 1902. It is located about one-eighth of a mile below the dam at the lower end of Independence Lake, Cal. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 94, where are given also references to publications that contain data for previous years.

The following measurement was made July 31, 1906:

Width, 16 feet; area, 25.6 square feet; gage height, 2.65 feet; discharge, 25.3 second-feet.

Daily gage height, in feet, of Independence Creek below Independence Lake, Cal., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.98	1.95	2.58	2.58	2.80	1.52	3.45	2.62	2.25	1.95	2.20	2.28
2	1.95	1.90	2.50	2.52	2.92	1.95	3.52	2.60	2.25	1.95	2.22	2.25
3	1.90	1.90	2.50	2.48	3.00	2.20	3.62	2.62	2.20	1.95	2.30	2.25
4	1.90	1.90	2.50	2.40	3.50	2.80	3.62	2.58	2.20	1.95	2.40	2.25
5	1.90	1.90	2.48	2.38	3.12	3.40	3.72	2.68	2.20	1.95	2.45	2.25
6	1.90	1.90	2.40	2.32	3.18	3.48	3.68	2.65	2.20	1.95	2.42	2.25
7	1.88	1.90	2.38	2.30	3.22	3.42	3.75	2.62	2.20	1.95	2.42	2.25
8	1.85	1.90	2.35	2.30	3.00	3.50	3.80	2.50	2.18	1.95	2.40	2.30
9	1.90	1.90	2.32	2.30	3.50	3.50	3.72	2.62	2.10	1.92	2.40	2.35
10	1.85	1.85	2.30	2.38	3.50	3.45	3.50	2.60	2.10	1.90	2.40	2.42
11	1.85	1.85	2.25	2.40	3.50	3.58	3.40	2.65	2.10	1.90	2.40	2.40
12	1.92	1.85	2.60	2.38	3.42	3.60	3.42	2.50	2.10	1.90	2.40	3.80
13	2.48	1.85	2.72	2.35	3.40	3.60	3.48	2.48	2.10	1.90	2.38	3.50
14	2.78	1.88	2.75	2.35	3.40	3.60	3.50	2.48	2.05	1.90	2.55	2.95
15	2.88	2.25	2.80	2.35	3.35	3.60	3.48	2.42	2.05	1.90	2.38	2.90
16	2.98	2.25	2.78	2.40	3.30	3.60	3.45	2.42	2.05	1.90	2.42	2.85
17	3.08	2.00	2.70	2.45	3.25	3.30	3.42	2.45	2.05	1.85	2.38	2.80
18	3.35	2.35	2.62	2.50	3.18	3.45	3.45	2.42	2.05	1.85	2.35	2.52
19	3.30	2.10	2.52	2.58	3.15	3.62	3.42	2.40	2.05	1.85	2.35	2.30
20	3.20	2.15	2.50	2.60	3.15	3.50	3.28	2.45	2.02	2.48	2.35	2.30
21	3.08	2.40	2.50	2.72	3.15	3.60	2.68	2.42	2.00	3.50	2.35	2.30
22	2.98	2.65	2.50	2.82	3.15	3.68	2.75	2.42	2.00	2.98	2.35	2.30
23	2.82	2.70	2.52	2.88	3.15	3.75	3.22	2.32	2.00	2.92	2.35	2.35
24	2.78	2.62	2.52	2.90	3.12	3.82	3.52	2.30	2.00	2.82	2.32	2.38
25	2.60	2.58	2.55	2.85	3.18	3.85	3.48	2.30	2.00	2.75	2.30	2.40
26	2.58	2.50	2.52	2.80	3.20	3.78	2.90	2.30	2.00	2.72	2.30	2.45
27	2.52	2.52	2.48	2.80	3.28	3.75	2.91	2.30	2.00	2.62	2.30	2.50
28	2.42	2.60	2.42	2.80	3.25	3.72	2.60	2.25	2.00	2.15	2.30	2.50
29	2.32	.....	2.38	2.75	3.18	3.60	2.58	2.25	2.00	2.20	2.30	2.50
30	2.12	.....	2.38	2.75	2.15	3.48	2.68	2.25	1.95	2.20	2.30	2.40
31	1.95	.....	2.52	.....	2.15	.....	2.65	2.25	.....	2.20	.....	2.18

WALKER RIVER BASIN.

DESCRIPTION OF BASIN.

Walker River is formed by two branches—East and West forks—which rise on the eastern slopes of the Sierra Nevada, in Mono County, Cal., flow in a general northerly direction, and unite in Lyon County, Nev. From the point of junction the main stream flows northward through Mason Valley, at the upper end of which it turns to the east and southeast and discharges into the north end of Walker Lake.

WEST FORK OF WALKER RIVER NEAR COLEVILLE, CAL.

This station was established October 5, 1902. The cable is located about 1 mile east of the point where the main road from Topaz to Bridgeport crosses Lost Canyon Creek and is 600 feet from the road. The gage is about one-half mile above the cable. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 99, where are given also references to publications that contain data for previous years.

Discharge measurements of West Fork of Walker River near Coleville, Cal., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 11	M. B. Kennedy	60	259	4.10	1,790
May 16	do	60	195	3.50	1,220
June 8	do	53	179	3.30	960
June 13	do	60	283	4.70	2,150
July 19	do	60	253	4.15	1,890
August 19	do	49	135	3.00	627

Daily gage height, in feet, of West Fork of Walker River near Coleville, Cal., in 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.1	1.3	1.4	1.6	2.9	3.0	5.1	3.3	2.2	1.5	1.5	1.3
2	1.1	1.3	1.6	1.6	3.1	3.2	5.3	3.25	2.1	1.5	1.4	1.3
3	0.9	1.3	1.4	1.6	3.1	3.4	5.45	3.1	2.1	1.5	1.4	1.3
4	1.1	1.3	1.3	1.6	3.5	3.6	5.45	3.0	2.1	1.4	1.4	1.3
5	1.1	1.3	1.3	1.6	3.8	3.7	5.4	3.0	2.0	1.4	1.5	1.3
6	1.1	1.3	1.3	1.5	3.9	3.5	5.35	3.0	2.0	1.4	1.5	1.3
7	1.1	1.3	1.3	1.5	4.0	3.3	5.25	3.1	2.1	1.4	1.5	1.4
8	1.1	1.2	1.3	1.6	4.0	3.5	5.35	3.0	2.1	1.4	1.4	1.4
9	1.1	1.2	1.3	1.7	4.1	3.5	4.9	3.0	2.0	1.4	1.4	1.4
10	1.1	1.2	1.3	2.0	4.1	4.35	4.6	2.9	2.0	1.4	1.4	1.4
11	1.1	1.2	1.4	1.9	4.1	4.8	4.7	2.9	2.0	1.4	1.4	1.4
12	1.1	1.2	1.5	1.9	3.9	5.2	4.45	2.9	2.0	1.4	1.4	1.4
13	1.2	1.2	1.4	2.0	3.9	5.2	4.45	2.9	2.0	1.4	1.4	1.4
14	1.2	1.2	1.4	2.1	3.9	4.55	5.0	2.9	2.0	1.4	1.4	1.4
15	1.2	1.2	1.3	2.2	3.7	4.8	4.6	2.8	2.2	1.4	1.4	1.4
16	1.2	1.2	1.4	2.3	3.6	5.35	4.3	2.7	2.1	1.4	1.4	1.4
17	1.2	1.2	1.4	2.5	3.5	4.9	4.45	2.6	2.0	1.4	1.4	1.4
18	1.5	1.2	1.4	2.6	3.6	4.75	4.15	2.6	1.9	1.4	1.4	1.4
19	1.5	1.2	1.4	2.7	3.8	5.15	4.0	3.0	1.8	1.4	1.3	1.3
20	1.4	1.2	1.4	2.9	3.8	5.25	4.15	2.8	1.7	1.4	1.3	1.3
21	1.3	1.2	1.5	2.9	3.8	5.15	4.1	2.6	1.7	1.4	1.3	1.3
22	1.3	1.3	1.5	3.2	3.7	5.15	4.15	2.5	1.7	1.3	1.3	1.3
23	1.3	1.3	1.5	3.1	3.5	4.9	4.4	2.4	1.7	1.4	1.3	1.3
24	1.3	1.2	1.6	3.1	3.5	4.75	4.35	2.4	1.6	1.4	1.3	1.3
25	1.2	1.3	1.6	3.0	3.5	5.15	4.35	2.2	1.5	1.4	1.4	1.4
26	1.2	1.3	1.6	2.8	3.3	4.95	4.3	2.2	1.5	1.4	1.3	1.4
27	1.2	1.3	1.5	2.9	3.3	4.45	4.25	2.2	1.5	1.4	1.3	1.5
28	1.2	1.3	1.6	2.9	3.2	4.25	3.85	2.2	1.5	1.4	1.3	1.5
29	1.3	.....	1.6	2.9	3.1	4.2	3.6	2.2	1.5	1.3	1.3	1.4
30	1.3	.....	1.7	2.7	3.0	4.25	3.55	2.2	1.5	1.4	1.3	1.4
31	1.3	.....	1.7	.....	3.0	.....	3.4	2.1	.....	1.4	.....	1.4

Rating table for West Fork of Walker River near Coleville, Cal., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.90	50	1.70	145	2.50	385	3.30	870	4.20	1,760
1.00	58	1.80	165	2.60	425	3.40	955	4.40	1,990
1.10	67	1.90	190	2.70	470	3.50	1,040	4.60	2,230
1.20	77	2.00	220	2.80	520	3.60	1,130	4.80	2,470
1.30	87	2.10	250	2.90	580	3.70	1,220	5.00	2,710
1.40	98	2.20	280	3.00	645	3.80	1,320	5.20	2,970
1.50	110	2.30	315	3.10	715	3.90	1,430	5.40	3,230
1.60	125	2.40	350	3.20	790	4.00	1,540		

NOTE.—This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1903–1906 and is fairly well defined.

Monthly discharge of West Fork of Walker River near Coleville, Cal., for 1906.

[Drainage area, 306 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	110	50	77.6	4,770	0.254	0.29
February	87	77	81.6	4,530	.267	.28
March	145	87	105	6,460	.343	.40
April	790	110	360	21,400	1.18	1.32
May	1,650	580	1,140	70,100	3.73	4.30
June	3,160	645	2,050	122,000	6.70	7.48
July	3,300	955	2,180	134,000	7.12	8.21
August	870	250	506	31,100	1.65	1.90
September	280	110	192	11,400	.627	.70
October	110	87	98.5	6,060	.322	.37
November	110	87	95.6	5,690	.312	.35
December	110	87	94.5	5,810	.309	.36
The year	3,300	50	582	423,000	1.90	25.96

NOTE.—The open-channel rating table was applied throughout the year; values for winter months are liable to error on account of ice.

EAST FORK OF WALKER RIVER NEAR YERINGTON, NEV.

This station was established October 6, 1902. It is located at Ross Ranch, about 10 miles southeast of Yerington, Nev., just above the point where the road crosses the river. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 101, where are given also references to publications that contain data for previous years.

Discharge measurements of East Fork of Walker River near Yerington, Nev., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 15	M. B. Kennedy	75	196	3.75	592
June 9	do	74	117	3.03	347
June 12	do	76	164	3.65	582
July 20	do	80	214	5.00	1,070
August 29	do	65	113	3.30	342

Daily gage height, in feet, of East Fork of Walker River near Yerington, Nev., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.9	2.1	2.4	2.7	2.9	2.9	4.6	4.4	3.1	2.4	2.3	2.6
2	1.9	2.1	2.4	2.6	3.0	2.8	4.5	4.25	3.1	2.4	2.3	2.6
3	1.9	2.1	2.4	2.5	3.1	2.8	4.6	4.1	3.1	2.4	2.3	2.6
4	1.9	2.1	2.4	2.4	3.1	2.8	4.7	4.0	3.0	2.4	2.3	2.6
5	1.9	2.1	2.4	2.4	3.2	2.9	4.85	3.9	3.0	2.5	2.3	2.7
6	1.9	2.1	2.4	2.4	3.4	2.9	5.0	3.8	2.9	2.5	2.3	2.7
7	1.9	2.1	2.4	2.4	3.5	3.0	5.1	3.9	2.9	2.5	2.3	2.7
8	1.9	2.1	2.4	2.4	3.5	3.1	5.4	3.9	2.9	2.5	2.3	2.7
9	1.9	2.1	2.4	2.4	3.6	3.2	5.1	3.9	2.9	2.5	2.3	2.7
10	1.9	2.1	2.4	2.5	3.7	3.3	5.1	3.9	2.8	2.5	2.3	2.8
11	1.9	2.2	2.4	2.7	3.9	3.5	5.0	3.9	2.8	2.6	2.3	2.8
12	1.9	2.2	2.4	2.6	4.0	3.6	4.95	3.9	2.8	2.6	2.3	2.8
13	2.0	2.1	2.8	2.6	3.9	3.85	4.85	3.7	2.8	2.6	2.4	2.8
14	2.0	2.1	2.8	2.5	3.6	4.0	4.8	3.7	2.8	2.6	2.4	2.8
15	2.0	2.1	2.4	2.5	3.5	4.1	4.75	3.6	2.8	2.6	2.4	2.8
16	2.0	2.1	2.4	2.5	3.4	4.2	4.7	3.6	2.8	2.5	2.4	2.8
17	2.0	2.1	2.4	2.6	3.3	4.3	4.75	3.6	2.7	2.5	2.4	2.9
18	2.25	2.2	2.3	2.6	3.2	4.5	4.7	3.75	2.7	2.5	2.4	2.9
19	2.9	2.3	2.3	2.6	3.2	4.7	4.6	3.8	2.7	2.5	2.4	2.9
20	3.6	2.3	2.3	2.6	3.2	4.7	4.6	4.0	2.7	2.5	2.4	2.9
21	3.1	2.5	2.4	2.7	3.3	4.7	4.6	4.0	2.6	2.5	2.4	2.9
22	2.7	2.45	2.5	2.8	3.3	4.8	4.6	3.8	2.6	2.5	2.4	2.9
23	2.6	2.4	2.6	2.8	3.3	4.8	4.9	3.7	2.6	2.5	2.4	2.9
24	2.5	2.4	2.85	2.8	3.2	4.8	5.0	3.6	2.5	2.5	2.4	2.9
25	2.4	2.4	3.1	2.8	3.2	4.8	4.8	3.5	2.5	2.4	2.5	2.9
26	2.2	2.4	3.1	2.8	3.3	4.8	4.9	3.5	2.5	2.4	2.5	2.9
27	2.2	2.4	3.0	2.8	3.3	4.8	4.95	3.4	2.5	2.4	2.5	2.9
28	2.2	2.4	2.7	2.9	3.3	4.95	4.85	3.3	2.4	2.4	2.5	2.9
29	2.2	.....	2.7	2.9	3.2	4.9	4.75	3.3	2.4	2.4	2.6	2.9
30	2.2	.....	2.8	2.9	3.1	4.65	4.65	3.2	2.4	2.4	2.6	2.9
31	2.2	.....	2.8	.....	3.0	.....	4.5	3.2	.....	2.4	.....	2.9

NOTE.—The river was frozen over January 1 to 12.

Rating tables for East Fork of Walker River near Yerington, Nev.

JANUARY 1 TO JULY 10, 1906.[a]

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.90	54	2.60	220	3.30	439	4.00	692	4.70	955
2.00	75	2.70	248	3.40	474	4.10	729	4.80	993
2.10	97	2.80	277	3.50	510	4.20	766	4.90	1,031
2.20	120	2.90	308	3.60	546	4.30	803	5.00	1,070
2.30	144	3.00	340	3.70	582	4.40	841	5.20	1,148
4.40	168	3.10	372	3.80	618	4.50	879	5.40	1,226
2.50	193	3.20	405	3.90	655	4.60	917		

JULY 11 TO DECEMBER 31, 1906.[b]

2.30	56	2.90	211	3.50	420	4.10	665	4.70	935
2.40	78	3.00	242	3.60	460	4.20	710	4.80	980
2.50	102	3.10	274	3.70	500	4.30	755	4.90	1,025
2.60	127	3.20	308	3.80	540	4.40	800	5.00	1,070
2.70	154	3.30	344	3.90	580	4.50	845		
2.80	182	3.40	381	4.00	620	4.60	890		

[a] This table is applicable only for open-channel conditions. It is based on 4 discharge measurements made during 1906 and is fairly well defined above gage height 2.5 feet; below this it is only approximate.
[b] This table is applicable only for open-channel conditions. It is based on 2 discharge measurements made during 1906 and is not well defined.

Monthly discharge of East Fork of Walker River near Yerington, Nev., for 1906.

[Drainage area, 1,100 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	546	54	127	7,810	0.115	0.13
February	193	97	124	6,890	.113	.12
March	372	144	210	12,900	.191	.22
April	398	168	228	13,600	.207	.23
May	692	308	457	28,100	.415	.48
June	1,050	277	690	41,100	.627	.70
July	1,230	845	987	60,700	.897	1.03
August	800	308	520	32,000	.473	.55
September	274	78	169	10,100	.154	.17
October	127	78	95.0	5,840	.086	.10
November	127	56	75.7	4,500	.069	.08
December	211	127	184	11,300	.167	.19
The year	1,230	54	322	235,000	.293	4.00

NOTE.—The open-channel rating table was applied throughout the year; values for the winter are liable to error on account of ice.

WALKER RIVER NEAR WABUSKA, NEV.

This station was established July 22, 1902, and equipped December 12, 1902. It is located about 300 feet above the Carson and Colorado Railroad bridge, near the section house at Clever station, and about 2½ miles east of Wabuska. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 103, where are given also references to publications that contain data for previous years.

Discharge measurements of Walker River near Wabuska, Nev., in 1906.

Date.	Hydrographer.	Width.	Area of section	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 14	M. B. Kennedy	70	408	4.20	1,470
June 11	do	75	272	3.30	921
July 21	do	178	600	4.50	2,310
August 27	do	70	174	1.60	410
September 14	C. L. Smith	50	75	.80	128

Daily gage height, in feet, of Walker River near Wabuska, Nev., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.00	1.50	1.52	1.72	2.40	2.75	5.05	3.92	1.12	0.80	1.65	1.95
2	1.00	1.42	1.55	1.80	2.35	2.65	4.90	3.70	1.10	.80	1.70	1.90
3	1.05	1.40	1.50	1.80	2.42	2.58	5.00	3.35	1.10	.80	1.70	1.75
4	1.05	1.40	1.40	1.72	2.60	2.55	5.15	3.18	1.08	.90	1.70	1.70
5	1.05	1.40	1.32	1.65	2.78	2.70	5.35	2.95	1.00	1.00	1.70	1.90
6	1.05	1.40	1.22	1.52	3.00	3.00	5.55	2.90	1.00	1.20	1.75	1.90
7	1.05	1.40	1.20	1.38	3.40	3.18	5.70	2.75	.92	1.38	1.80	1.90
8	1.05	1.40	1.28	1.30	3.75	3.05	5.65	2.70	.82	1.40	1.80	2.05
9	1.05	1.40	1.30	1.32	3.80	2.92	5.80	2.70	.72	1.40	1.80	2.22
10	1.05	1.40	1.18	1.38	3.95	2.92	5.88	2.58	.68	1.40	1.80	2.32
11	1.05	1.40	1.08	1.40	4.20	3.38	5.85	2.55	.65	1.48	1.88	2.40
12	1.08	1.38	1.05	1.45	4.42	3.85	5.60	2.55	.65	1.50	1.90	2.40
13	1.15	1.20	1.38	1.55	4.32	4.30	5.30	2.50	.65	1.50	1.80	2.45
14	1.15	1.15	1.62	1.60	4.15	4.70	5.28	2.50	.70	1.48	1.80	2.35
15	1.55	1.18	1.52	1.60	4.05	5.05	5.40	2.50	.70	1.45	1.80	2.30
16	1.75	1.20	1.48	1.60	4.05	5.10	5.45	2.15	.70	1.45	1.80	2.42
17	1.85	1.30	1.40	1.70	3.88	4.95	5.22	2.00	.70	1.45	1.80	2.38
18	1.85	1.30	1.35	1.80	3.55	5.15	5.00	1.98	.70	1.45	1.80	2.30
19	1.88	1.25	1.30	1.90	3.45	5.22	4.95	1.95	.75	1.50	1.80	2.28
20	2.15	1.25	1.25	2.00	3.45	5.35	4.75	2.05	.80	1.50	1.80	2.25
21	2.30	1.35	1.20	2.05	3.65	5.38	4.50	2.10	.85	1.55	1.80	2.18
22	2.20	1.60	1.12	2.32	3.75	5.40	4.38	2.05	.85	1.55	1.80	2.10
23	2.02	1.70	1.10	2.40	3.75	5.40	4.35	1.95	.85	1.60	1.80	2.10
24	1.88	1.70	1.15	2.55	3.60	5.48	4.72	1.90	.85	1.60	1.80	2.10
25	1.80	1.65	1.58	2.65	3.40	5.50	5.22	1.75	.85	1.60	1.80	2.08
26	1.80	1.55	1.98	2.55	3.18	5.40	5.32	1.62	.85	1.60	1.90	2.00
27	1.72	1.50	2.05	2.45	3.10	5.45	5.25	1.50	.85	1.70	1.98	2.00
28	1.70	1.50	1.90	2.45	3.00	5.40	5.22	1.42	.85	1.70	2.08	2.25
29	1.62	.....	1.75	2.45	3.00	5.32	5.18	1.32	.80	1.68	2.02	2.40
30	1.55	.....	1.70	2.40	3.00	5.20	4.68	1.30	.80	1.65	1.98	2.42
31	1.50	.....	1.70	.....	2.95	.....	4.10	1.22	.....	1.65	.....	2.32

NOTE.—Ice conditions unknown. No discharges have been computed on account of the constant changes in channel and the small number of measurements.

CARSON RIVER BASIN.

DESCRIPTION OF BASIN.

Carson River has its sources on the eastern slopes of the Sierra Nevada in Alpine County, Cal. Flowing northward into Nevada, East and West forks unite near Genoa, in the upper Carson Valley. At Empire, 3 miles east of the city of Carson, the river turns to the northeast and enters a deep canyon, through which it flows for several miles, emerging into a second, smaller valley a short distance above the town of Dayton. After leaving this valley it passes through two shorter canyons and one rather large valley before entering lower Carson Valley, or Carson Sink Valley, as it is also known, and discharging its waters into Carson Sink.

WEST FORK OF CARSON RIVER NEAR WOODFORDS, CAL.

West Fork of Carson River rises in Alpine County, Cal., flows in a general northerly direction, and unites with east Fork in Douglas County, Nev.

The gaging station was established October 18, 1900. It is located about three-fourths of a mile above the post-office at Woodfords, Cal., and 200 feet from the main road between Woodfords and Blue Lakes. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 106, where are given also references to publications that contain data for previous years.

Discharge measurements of West Fork of Carson River near Woodfords, Cal., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 9	M. B. Kennedy	32	180	6.70	1,520
May 18	do	38	130	5.10	695
June 5	do	40	154	5.20	764
June 16	do	37	157	5.60	899
July 17	do	30	105	4.10	373
August 16	do	30	60	3.05	108

Daily gage height, in feet, of West Fork of Carson River near Woodfords, Cal., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.4	2.85	2.5	2.85	5.7	4.4	4.6	3.4	.....	2.4	2.7	2.0
2	2.5	2.8	2.55	2.8	5.85	4.6	4.7	3.3	2.9	2.4	2.7	2.1
3	2.55	2.75	2.55	2.8	6.0	4.8	4.8	3.3	2.9	2.4	2.95	2.1
4	2.55	2.6	2.5	2.75	6.1	5.0	4.7	3.3	2.85	2.4	3.1	2.15
5	2.4	2.6	2.55	2.6	6.4	5.0	4.7	3.25	2.8	2.4	3.3	2.1
6	2.4	2.6	2.6	2.55	6.45	4.7	4.7	3.3	2.7	2.55	3.0	2.1
7	2.4	2.6	2.65	2.5	6.5	4.9	4.7	3.3	2.6	2.6	2.9	2.0
8	2.3	2.55	2.7	2.6	6.7	4.8	4.6	3.25	2.55	2.55	2.9	2.5
9	2.35	2.5	2.75	2.6	6.8	4.8	4.5	3.9	2.5	2.5	2.85	2.6
10	2.5	2.4	2.6	2.7	6.8	5.2	4.4	3.5	2.5	2.5	2.8	2.7
11	2.6	2.5	2.55	2.7	6.4	5.5	4.3	3.4	2.4	2.45	2.9	2.7
12	2.75	2.55	2.5	2.75	6.35	5.8	4.2	3.4	2.4	2.4	2.9	2.6
13	2.85	2.6	2.45	2.8	.....	5.7	4.2	3.4	2.3	2.4	3.1	2.7
14	2.9	2.7	2.4	2.9	.....	5.8	4.1	3.35	2.4	2.45	3.2	2.65
15	2.9	2.75	2.4	2.95	.....	5.8	4.0	.....	2.2	2.4	3.0	2.6
16	3.0	2.75	2.45	3.0	.....	5.7	4.0	.....	2.2	2.4	3.0	2.6
17	3.1	2.8	2.5	3.25	5.1	5.6	3.8	.....	2.2	2.45	2.9	2.55
18	3.2	2.8	2.5	3.3	.....	5.5	3.7	3.4	2.2	2.4	2.8	2.5
19	3.1	2.85	2.55	3.5	5.0	5.3	3.65	3.4	2.3	2.5	2.6	2.55
20	3.0	2.8	2.6	3.7	4.9	5.0	3.5	3.3	2.2	2.5	2.6	2.6
21	3.0	2.8	2.65	3.85	4.9	5.0	3.4	3.35	2.2	2.6	2.55	2.65
22	2.9	2.75	2.7	4.1	4.95	5.0	3.3	3.4	2.3	2.6	2.55	2.7
23	2.65	2.7	2.8	4.2	5.0	4.9	3.35	3.35	2.4	2.6	2.55	2.7
24	2.4	2.6	2.8	4.3	5.1	4.9	3.2	3.35	2.5	2.65	2.5	2.7
25	2.5	2.55	2.8	4.4	4.95	4.8	3.2	3.3	2.5	2.65	2.45	2.75
26	2.6	2.5	2.9	4.6	4.9	4.7	4.3	3.3	2.4	2.6	2.4	2.8
27	2.75	2.5	2.95	4.85	.....	4.8	3.6	3.3	2.35	2.65	2.4	2.8
28	2.8	2.5	2.95	5.1	.....	4.8	3.55	3.25	2.35	2.6	2.3	2.85
29	2.8	.....	3.0	5.3	.....	4.7	3.4	3.2	2.30	2.55	2.2	2.9
30	2.85	.....	3.0	5.5	.....	4.8	3.3	3.2	2.35	2.6	2.15	2.85
31	2.85	.....	2.9	.....	.....	.....	3.3	.....	.....	2.65	.....	2.85

Rating table for West Fork of Carson River near Woodfords, Cal., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.00	22	2.90	90	3.80	251	4.70	535	6.20	1,220
2.10	26	3.00	102	3.90	277	4.80	570	6.40	1,330
2.20	31	3.10	115	4.00	305	4.90	610	6.60	1,450
2.30	37	3.20	129	4.10	335	5.00	650	6.80	1,570
2.40	44	3.30	145	4.20	365	5.20	730		
2.50	52	3.40	163	4.30	395	5.40	820		
2.60	60	3.50	182	4.40	430	5.60	910		
2.70	69	3.60	203	4.50	465	5.80	1,010		
2.80	79	3.70	226	4.60	500	6.00	1,110		

NOTE.—This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1902–1906, and is fairly well defined.

Monthly discharge of West Fork of Carson River near Woodfords, Cal., for 1906.

[Drainage area, 70 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	129	37	72.3	4,450	1.03	1.19
February	84	44	65.3	3,630	.933	.97
March	102	44	66.5	4,090	.950	1.10
April	865	52	236	14,000	3.37	3.76
May	1,570	460	925	56,900	13.20	15.22
June	1,010	430	690	41,100	9.86	11.00
July	570	129	324	19,900	4.63	5.34
August	277	116	154	9,470	2.20	2.54
September	103	31	50.4	3,000	.720	.80
October	65	44	52.8	3,250	.754	.87
November	145	28	76.9	4,580	1.10	1.23
December	90	22	58.4	3,590	.834	.96
The year	1,570	22	231	168,000	3.30	44.98

NOTE.—Discharges have been interpolated on days when gage was not read. The open-channel rating table was applied throughout the year; values for winter months are liable to some error on account of ice.

EAST FORK OF CARSON RIVER NEAR GARDNERVILLE, NEV.

East Fork of Carson River rises in southeastern Alpine County, flows in a general northerly direction, and joins West Fork in Douglas County, Nev.

The gaging station was established October 17, 1900. It is located about 5 miles southeast of Gardnerville and one-half mile southwest of Rodenbah's ranch. It is within one-half mile of the main traveled road between Carson, Nev., and Bridgeport, Cal., and is about 400 feet above a bridge across the river. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 108, where are given also references to publications that contain data for previous years.

Discharge measurements of East Fork of Carson River near Gardnerville, Nev., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 10	M. B. Kennedy	103	490	[a] 5.60	2,820
May 17	do	92	352	[a] 4.75	1,610
June 6	do	92	343	[a] 4.60	1,470
June 15	do	92	457	[b] 6.45	2,400
July 18	do	84	348	[b] 5.65	1,650
August 17	do	84	194	[b] 4.05	415
September 6	C. L. Smith	85	165	[b] 3.90	182

[a] At new gage established October 8, 1905. [b] At old gage used prior to October 8, 1905.

Daily gage height, in feet, of East Fork of Carson River near Gardnerville, Nev., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	1.98	2.75	2.72	3.10	4.20	4.60	5.40	4.00	2.75	2.50	3.58	2.54
2	1.98	2.72	2.72	3.10	4.40	4.70	5.80	3.90	2.75	2.50	3.57	2.54
3	1.98	2.72	2.71	3.20	4.70	4.70	5.50	3.80	2.75	2.50	3.55	2.54
4	1.98	2.72	2.71	3.25	5.00	4.70	5.30	3.70	2.75	2.50	3.54	2.54
5	1.98	2.72	2.70	3.28	5.10	4.75	5.20	3.65	2.70	2.50	3.59	2.54
6	1.98	2.72	2.70	3.30	5.90	4.80	5.00	3.60	2.70	2.50	3.60	2.54
7	1.99	2.72	2.70	3.30	5.80	4.80	5.00	3.50	2.70	2.55	3.58	2.54
8	2.00	2.72	2.70	3.30	5.80	4.80	4.80	3.50	2.70	2.58	3.56	2.54
9	2.00	2.72	2.71	3.40	5.80	4.90	4.60	3.45	2.60	2.60	3.53	2.54
10	2.05	2.72	2.73	3.45	6.00	5.00	4.60	3.45	2.60	2.60	3.50	2.54
11	2.05	2.74	2.73	3.46	6.00	5.00	4.50	3.44	2.60	2.61	3.50	2.54
12	2.05	2.74	2.74	3.47	5.90	5.40	4.80	3.44	2.60	2.63	3.58	2.54
13	2.05	2.74	2.75	3.48	5.80	5.50	5.10	3.43	2.60	2.65	2.58	2.55
14	.....	2.73	2.75	3.49	5.60	5.80	4.70	3.43	2.59	2.67	2.58	2.56
15	.....	2.73	2.74	4.00	5.50	5.90	4.60	3.43	2.59	2.69	2.57	2.56
16	.....	2.73	2.74	4.00	5.50	5.90	4.60	3.42	2.58	3.00	2.56	2.54
17	.....	2.74	2.72	4.10	5.40	6.00	4.50	3.15	2.58	3.10	2.56	2.54
18	.....	2.74	2.75	4.20	5.40	6.10	4.50	3.15	2.58	3.20	2.56	2.53
19	.....	2.74	2.75	4.20	5.30	6.40	4.40	3.00	2.58	3.40	2.56	2.53
20	.....	2.74	2.77	4.40	4.80	6.40	4.40	3.00	2.56	3.50	2.55	2.53
21	2.82	2.74	2.77	4.50	4.80	6.00	4.37	2.90	2.56	3.50	2.55	2.53
22	2.80	2.73	2.79	4.60	4.60	6.20	4.35	2.90	2.56	3.70	2.55	2.53
23	2.70	2.73	2.80	4.40	4.60	6.10	4.35	2.90	2.54	3.70	2.55	2.53
24	2.70	2.74	2.81	4.30	4.40	5.50	4.43	2.90	2.54	3.70	2.55	2.53
25	2.80	2.73	2.81	4.25	4.30	6.00	4.60	2.80	2.54	3.70	2.54	2.53
26	2.80	2.72	2.80	4.15	4.30	5.60	4.90	2.80	2.53	3.65	2.54	2.53
27	2.80	2.72	2.80	3.98	4.40	5.50	4.80	2.80	2.53	3.64	2.54	2.53
28	2.75	2.72	2.80	3.96	4.50	5.20	4.70	2.70	2.51	3.63	2.54	2.53
29	2.75	.....	2.79	3.94	4.50	5.20	4.60	2.70	2.50	3.62	2.54	2.54
30	2.75	.....	2.79	4.00	4.55	5.40	4.30	2.70	2.50	3.61	2.54	2.54
31	2.75	.....	2.78	.....	4.58	.....	4.00	2.70	.....	3.59	.....	2.54

NOTE.—Ice conditions not known. Gage heights refer to new gage established October 8, 1905.

CARSON RIVER NEAR EMPIRE, NEV.

This station was established October 21, 1900. It is located about three-fourths of a mile east of Brunswick Mill and 2½ miles east of Empire, Nev. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 111, where are given also references to publications that contain data for previous years.

Discharge measurements of Carson River near Empire, Nev., by M. B. Kennedy in 1906.

Date.	Width.	Area of section.	Gage height.	Discharge.
	Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 7	90	421	6.20	2,210
May 21	90	412	5.90	2,030
June 4	88	383	5.40	1,660
June 17	89	459	6.50	2,400
July 16	90	450	5.90	2,160
July 27	88	367	5.20	1,530
August 14	78	224	3.60	475

Daily gage height, in feet, of Carson River near Empire, Nev., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	2.6	2.9	3.1	4.0	4.7	4.7	5.9	4.3	2.4	2.2	2.8	2.6
2	2.7	2.9	3.0	3.8	4.8	4.8	6.0	4.1	2.5	2.2	2.8	2.7
3	2.5	2.9	3.0	3.7	5.0	4.9	6.3	4.0	2.4	2.2	2.8	2.9
4	2.4	2.9	3.0	3.5	5.4	5.1	6.4	3.9	2.3	2.4	2.8	2.9
5	2.4	2.9	3.0	3.4	5.7	5.5	6.5	3.8	2.2	2.5	3.2	2.9
6	2.4	2.9	3.0	3.4	5.9	5.9	6.6	3.6	2.2	2.5	3.2	2.9
7	2.4	2.9	2.9	3.5	6.1	5.7	6.6	3.5	2.1	2.5	3.2	3.0
8	2.4	2.9	2.9	3.6	6.3	5.2	6.5	3.4	2.0	2.5	3.1	3.3
9	2.4	2.9	3.0	3.8	6.4	5.3	6.4	3.6	2.1	2.6	3.1	3.7
10	2.5	2.9	3.0	4.0	6.5	5.7	6.4	3.6	2.1	2.6	3.1	3.6
11	2.6	2.9	3.0	4.2	6.5	6.1	6.2	3.7	1.9	2.6	3.0	3.8
12	2.8	2.9	3.3	4.1	6.7	6.5	6.0	3.8	1.9	2.6	3.0	4.6
13	3.2	2.9	4.1	4.0	6.5	6.9	5.9	3.7	2.1	2.6	3.0	4.0
14	4.9	2.8	3.7	4.1	6.3	7.2	6.0	3.6	2.2	2.6	3.0	3.5
15	4.0	2.9	3.6	4.1	6.2	7.0	5.9	3.5	2.2	2.7	3.0	3.4
16	3.4	3.2	3.5	4.3	6.2	6.6	5.8	3.3	2.3	2.7	3.0	3.3
17	4.5	3.1	3.5	4.5	6.0	6.6	5.6	3.3	2.5	2.6	3.0	3.3
18	4.9	3.0	3.3	4.6	5.7	6.9	5.5	3.2	2.5	2.6	3.0	3.2
19	5.5	3.1	3.2	4.7	5.7	6.8	5.3	3.2	2.5	2.6	3.0	3.2
20	5.9	3.3	3.1	4.8	6.0	6.5	5.0	3.1	2.4	2.7	3.0	3.2
21	4.0	3.4	3.3	4.9	6.1	6.7	4.9	3.0	2.4	2.7	2.9	3.2
22	3.6	3.5	3.4	5.0	6.0	6.7	4.9	3.0	2.4	2.7	2.8	3.2
23	3.4	3.4	3.6	5.2	5.9	6.7	4.8	2.9	2.3	2.7	2.9	3.2
24	3.3	3.3	3.7	5.4	5.6	6.7	5.0	2.9	2.3	2.7	2.9	3.2
25	3.2	3.2	4.5	5.0	5.4	6.5	5.0	2.9	2.2	2.7	2.8	3.3
26	3.2	3.1	4.4	4.6	5.3	6.5	5.4	2.9	2.2	2.7	2.8	3.4
27	3.0	3.1	4.0	4.5	5.3	6.5	5.3	2.8	2.2	2.7	2.8	3.8
28	3.0	3.1	3.8	4.6	5.3	6.3	5.1	2.7	2.2	2.7	2.7	4.0
29	3.0	.....	3.6	4.7	5.1	6.1	4.9	2.7	2.2	2.7	2.6	3.9
30	2.9	.....	3.7	4.7	5.0	5.9	4.7	2.5	2.2	2.7	2.6	3.8
31	2.9	.....	3.7	.....	4.9	.....	4.5	2.4	.....	2.7	.....	3.7

Rating table for Carson River near Empire, Nev., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
1.90	51	2.80	223	3.70	554	4.60	1,090	5.80	1,970
2.00	63	2.90	251	3.80	603	4.70	1,166	6.00	2,120
2.10	77	3.00	281	3.90	654	4.80	1,230	6.20	2,270
2.20	93	3.10	313	4.00	708	4.90	1,300	6.40	2,420
2.30	110	3.20	347	4.10	765	5.00	1,370	6.60	2,570
2.40	129	3.30	384	4.20	825	5.20	1,520	6.80	2,720
2.50	150	3.40	423	4.30	890	5.40	1,670	7.00	2,870
2.60	173	3.50	464	4.40	955	5.60	1,820	7.20	3,020
2.70	197	3.60	508	4.50	1,020				

NOTE.—This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1902–1906 and is well defined below gage heights 5.4 feet.

Monthly discharge of Carson River near Empire, Nev., for 1906.

[Drainage area, 988 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	2,040	129	477	29,300	0.483	0.56
February	464	223	298	16,600	.302	.31
March	1,020	251	452	27,800	.457	.53
April	1,670	423	914	54,400	.925	1.03
May	2,640	1,160	1,940	119,000	1.96	2.26
June	3,020	1,160	2,240	133,000	2.27	2.53
July	2,570	1,020	1,860	114,000	1.88	2.17
August	890	129	418	25,700	.423	.49
September	150	51	101	6,010	.102	.11
October	197	93	172	10,600	.174	.20
November	347	173	262	15,600	.265	.30
December	1,090	173	436	26,800	.441	.51
The year	3,020	51	798	579,000	.807	11.00

NOTE. The open-channel rating table was applied throughout the year; values for winter months may be somewhat in error on account of ice.

OWENS RIVER DRAINAGE BASIN.

Owens River has its source in the Sierra Nevada, in eastern California, and flows southeastward, parallel with this range, finally discharging its waters into Owens Lake. Its basin has a length from north to south of approximately 150 miles and a width of from 20 to 25 miles; it lies between the Sierra Nevada on the west and the White Mountains on the east. Practically the entire flow is derived from the Sierra Nevada, as it drains the eastern slope of this range from Mount Lyell, on the north, to a point some distance below Mount Whitney, on the south.

The results of data collected in Owens River Valley in 1906 are contained in Water-Supply Paper No. 213, which presents the results of all the hydrographic data collected in the State of California during 1906.

GREAT BASIN DRAINAGE IN OREGON.

DESCRIPTION.

The Great Basin in Oregon comprises about one-fourth of the area of the State. The surface waters throughout this area drain into the natural depressions in the ground, the water either evaporating or, if the flow is sufficient, forming perennial lakes. The area is generally high and rolling, and the average elevation is about 4,000 feet. Forests, except on the borders of this basin, are small. The soil is rough, sparsely covered with grass, and is given largely to range for sheep and cattle. The rainfall throughout the basin is about 12 inches per annum. The principal lakes are Harney, Malheur, Warner, Summer, Silver, Christmas, Goose, and Abert. With the exception of Silver Lake, all are alkaline. The surface waters of this basin are very valuable for irrigation developments, but unfortunately are

insufficient. The irrigated valley lands contiguous to the streams have been taken, and the low-water flow of the principal streams is entirely used.

Investigations of the surface-water supply in this basin has been limited to the following streams, which are classified by the lakes into which they flow: Silvies River, discharging into Malheur Lake; Silver Creek into Harney Lake; Silver, Bridge, and Bear creeks into Silver Lake; Summer Creek and Ana River into Summer Lake, and Chewaucan River into Abert Lake.

MALHEUR LAKE BASIN.

MALHEUR LAKE AT THE NARROWS, OREGON.

This station was established May 14, 1903, and discontinued March 31, 1906. It is located at the highway bridge across The Narrows. The station is maintained for the purpose of obtaining data in regard to the fluctuations of the lake, which has no outlet. The gage and the bench mark are described in Water-Supply Paper No. 176, page 121, where are given also references to publications that contain data for previous years.

The following gage heights were observed in 1906:

Gage heights of Malheur Lake at The Narrows, Oregon, in 1906.

	Feet.
January 6 to March 3	3.6
March 10	3.75
March 17 and 24	3.9
March 31	4.45

SILVIES RIVER NEAR BURNS, OREG.

This station was established May 10, 1903, and was discontinued July 24, 1906. It was located about 10 miles above Burns, Oreg. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 122, where are given also references to publications that contain data for previous years.

Discharge measurements of Silvies River near Burns, Oreg., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 8	M. L. Lewis	55	396	7.40	479
May 23	do	67	544	5.30	330
June 29	Stevens and Landes	55	125	4.42	250

Daily gage height, in feet, of Silvies River near Burns, Oreg., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	2.4	2.45	2.6	10.6	10.4	9.75	4.3
2	2.45	2.45	2.6	9.8	10.0	9.4	4.0
3	2.45	2.45	2.6	9.0	9.75	8.6	3.8
4	2.45	2.45	2.6	8.8	9.5	8.5	3.6
5	2.5	2.45	2.6	9.65	9.08	9.2	3.4
6	2.5	2.45	2.6	11.5	8.6	9.3	3.4
7	2.5	2.45	2.6	13.25	7.75	9.35	3.2
8	2.5	2.5	2.6	14.4	7.2	9.5	3.1
9	2.5	2.5	2.6	14.88	7.25	9.5	3.1
10	2.5	2.5	2.6	14.9	6.85	9.2	3.0
11	2.5	2.55	2.6	14.6	6.38	9.2	3.0
12	2.5	2.6	2.6	14.4	6.35	9.0	2.9
13	2.5	2.6	2.5	14.0	6.15	8.7	2.8
14	2.5	2.6	2.5	13.9	6.15	8.0	2.6
15	2.5	2.6	2.5	14.0	6.15	7.8	2.6
16	2.6	2.6	2.5	14.15	5.9	7.1	2.6
17	2.6	2.6	2.5	14.3	5.5	7.1	2.6
18	2.6	2.6	2.5	14.08	5.5	6.8	2.6
19	2.6	2.6	2.5	13.92	5.5	6.0	2.6
20	2.6	2.6	2.5	13.82	5.5	5.7	2.6
21	2.6	2.6	2.5	13.68	5.5	5.0	2.6
22	2.6	2.6	2.6	14.0	5.5	4.7	2.6
23	2.6	2.6	2.75	13.98	5.25	4.0	2.6
24	2.6	2.6	2.8	13.7	5.15	4.0	2.6
25	2.5	2.6	3.0	13.4	5.15	4.0	.....
26	2.5	2.6	3.8	13.3	5.4	4.0	.....
27	2.5	2.6	4.1	13.0	5.6	4.3	.....
28	2.45	2.6	4.6	12.9	6.6	4.4	.....
29	2.45	.....	4.8	12.7	7.4	4.4	.....
30	2.45	.....	6.35	11.9	8.0	4.3	.....
31	2.45	.....	8.8	.....	8.6	.....	.....

Rating table for Silvies River near Burns, Oreg., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.40	11	3.50	110	4.60	209	6.40	371	8.60	569
2.50	20	3.60	119	4.70	218	6.60	389	8.08	587
2.60	29	3.70	128	4.80	227	6.80	407	9.00	605
2.70	38	3.80	137	4.90	236	7.00	425	10.00	700
2.80	47	3.90	146	5.00	245	7.20	443	11.00	810
2.90	56	4.00	155	5.20	263	7.40	461	12.00	935
3.00	65	4.10	164	5.40	281	7.60	479	13.00	1,100
3.10	74	4.20	173	5.60	299	7.80	497	14.00	1,412
3.20	83	4.30	182	5.80	317	8.00	515	15.00	2,080
3.30	92	4.40	191	6.00	335	8.20	533	16.00	3,170
3.40	101	4.50	200	6.20	353	8.40	551		

NOTE.—This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1904–6 and is not well defined for 1906.

Monthly discharge of Silvies River near Burns, Oreg., for 1906.

[Drainage area, 865 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	29	11	21.4	1,320	0.025	0.03
February	29	16	24.6	1,370	.028	.03
March	587	20	77.5	4,770	.090	.10
April	2,010	587	1,260	75,000	1.46	1.63
May	742	259	416	25,600	.481	.55
June	675	155	428	25,500	.495	.55
July (1–24)	182	29	65.8	3,130	.076	.07
The period				137,000		

NOTE.—The open-channel rating table was applied throughout the period; values for the winter months may be somewhat in error on account of ice.

HARNEY LAKE BASIN.

SILVER CREEK NEAR RILEY, OREG.

Silver Creek rises in the extreme northwestern part of Harney County, Oreg., and flows southeastward into the north end of Harney Lake.

The gaging station was established April 19, 1904, and discontinued July 14, 1906. It is located 12 miles above Riley, Oreg., on the Burns-Shaniko stage line, and is 6 miles below the proposed reservoir site on Silver Creek. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 125, where are given also references to publications that contain data for previous years.

Discharge measurements of Silver Creek near Riley, Oreg., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
May 10	M. L. Lewis	34	54	6.10	64
June 1	Lewis and Stevens	45	130	8.10	184
June 27	I. Landes	34	46	5.78	43

Daily gage height, in feet, of Silver Creek near Riley, Oreg., for 1906.

Day	Feb.	Mar.	Apr.	May.	June.	July.	Day.	Feb.	Mar.	Apr.	May.	June.	July.
1	5.10	6.00	12.00	.....	8.00	.....	17	5.10	.....	12.30	6.00	.....	.....
2	5.10	6.50	11.00	7.30	7.90	5.60	18	5.10	5.70	12.00	6.80	6.90	.....
3	5.10	6.50	11.50	7.00	.....	5.50	19	.....	.....	12.70	5.40	6.70	.....
4	5.10	6.50	10.50	7.00	8.90	5.50	20	6.70	6.30	11.00	.....	6.50	.....
5	.....	.....	12.00	6.90	8.70	5.40	21	7.70	6.80	11.00	5.50	6.40	.....
6	5.10	7.00	11.50	.....	8.80	5.40	22	5.10	7.00	10.70	5.70	6.30	.....
7	5.10	6.00	11.00	6.70	8.70	5.30	23	5.10	7.30	.....	5.90	6.10	.....
8	5.10	6.50	12.50	6.50	8.50	.....	24	5.10	7.00	10.50	6.00	.....	.....
9	5.10	5.50	.....	6.40	8.70	5.20	25	5.10	7.00	10.00	6.00	5.50	.....
10	5.10	5.90	12.30	6.30	.....	5.20	26	.....	.....	9.70	6.10	5.70	.....
11	5.10	5.90	12.00	6.10	7.80	5.10	27	7.00	7.50	9.50	.....	5.80	.....
12	.....	.....	11.30	6.00	7.50	5.10	28	7.30	8.00	8.30	5.70	5.80	.....
13	5.10	.....	11.80	.....	7.00	5.00	29	.....	7.00	8.00	7.90	5.70	.....
14	5.10	.....	11.80	6.00	6.80	5.00	30	.....	9.00	.....	8.10	.....	.....
15	5.10	.....	12.00	5.90	6.50	.....	31	.....	8.50	.....	8.10	.....	.....
16	5.10	.....	.....	6.00	6.00	.....							

Rating table for Silver Creek near Riley, Oreg., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
4.20	.0	5.20	25	6.10	62	7.00	113	8.80	237
4.30	0.2	5.30	29	6.20	67	7.20	125	9.00	253
4.40	.6	5.40	33	6.30	72	7.40	137	9.20	269
4.50	1.0	5.50	37	6.40	77	7.60	150	9.40	285
4.60	3	5.60	41	6.50	83	7.80	164	9.60	302
4.70	6	5.70	45	6.60	89	8.00	178	9.80	320
4.80	9	5.80	49	6.70	95	8.20	192	10.00	338
4.90	13	5.90	53	6.80	101	8.40	206	11.00	428
5.00	17	6.00	57	6.90	107	8.60	221	12.00	518
5.10	21								

NOTE.—This table is applicable only for open-channel conditions. It is based on 3 discharge measurements made during 1906 and 2 during 1905 and is fairly well defined.

Monthly discharge of Silver Creek near Riley, Oreg., for 1906.

Month.	Discharge in second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
February	157	21	38.7	2,150
March	253	37	92.5	5,690
April	581	162	435	25,900
May	185	33	82.5	5,070
June	245	37	123	7,320
July (1-14)	43	17	29.0	805
The period				46,900

NOTE.—The open-channel rating has been applied throughout the period; values for winter months are liable to some error on account of ice. Discharges have been interpolated for days on which gage was not read.

SILVER LAKE BASIN.

SILVER CREEK NEAR SILVER LAKE, OREG.

Silver Creek rises in the western part of Lake County, Oreg., flows northward to Pauline Lake and Marsh, then turns abruptly to the southeast and enters Silver Lake.

The gaging station was established December 29, 1904. It is located 0.9 mile above the county bridge, 1.6 miles southwest of Silver Lake, Oreg. The conditions at this station and the bench marks are described in Water-Supply Paper No. 176, page 127.

Discharge measurements of Silver Creek near Silver Lake, Oreg., in 1906.

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
	Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*		*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 9	43	175	5.52	664	May 5	34	91	3.65	288
April 9	38	130	4.48	412	May 11	25.5	61	2.45	147
April 28	31	84	3.23	219	May 23	22	35	1.45	53
April 30	32	85	3.48	258					

Daily gage height, in feet, of Silver Creek near Silver Lake, Oreg., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	0.85	0.95	1.0	2.2	3.4	2.15	0.9	0.7	0.7	0.65	0.65	0.4
2	.9	.9	.95	1.5	3.1	1.5	.85	.65	.7	.65	.7	.4
3	1.2	.5	.95	2.0	.....	1.5	.85	.65	.7	.65	.65	.4
4	.9	.95	.6	1.8	3.25	1.3	.8	.65	.7	.65	.65	.4
5	.85	.85	.6	2.6	3.25	1.55	.8	.65	.7	.65	.75	.7
6	.85	1.1	.7	3.5	3.0	2.0	.8	.65	.7	.65	.7	.7
7	.8	.8	.9	4.3	3.0	1.8	.8	.65	.7	.65	.7	.7
8	.8	.95	.9	4.0	2.8	2.0	.8	.65	.7	.65	.7	.7
9	.9	.95	1.05	4.95	2.8	2.0	.75	.65	.7	.65	.75	.7
10	.9	1.0	1.0	4.8	2.6	1.8	.75	.65	.75	.65	.75	.75
11	.9	1.0	1.2	4.0	2.6	1.6	.75	.65	.75	.7	.65	.7
12	.95	1.15	1.6	4.2	2.3	1.4	.75	.75	.7	.7	.65	.7
13	.9	1.15	1.6	4.8	2.0	1.4	.75	.75	.7	.65	.65	.7
14	.95	1.0	1.4	4.6	2.1	1.4	.75	.7	.7	.65	.65	.75
15	.8	1.2	1.1	3.9	2.1	1.2	.8	.65	.7	.65	.65	.75
16	1.4	1.0	1.0	4.9	1.8	1.2	.8	.65	.7	.65	.65	.6
17	1.4	.8	.85	4.6	1.6	1.01	.75	.65	.7	.65	.65	.6
18	.85	1.8	.95	4.2	1.4	.9	.75	.65	.7	.65	.65	.6
19	.95	1.6	.8	4.2	1.4	.9	.75	.7	.7	.65	.65	.6
20	.85	1.3	.95	4.0	1.4	.9	.75	.7	.7	.65	.7	.6
21	.95	1.3	.85	4.9	1.35	.9	.75	.7	.7	.65	.7	.6
22	1.2	.95	.9	4.9	1.4	.9	.75	.7	.7	.65	.7	.65
23	.9	.8	.9	4.0	1.45	.9	.75	.75	.7	.65	.65	.7
24	1.0	.8	1.2	3.5	1.3	.9	.75	.7	.7	.65	.65	1.0
25	1.0	.65	1.2	3.0	1.3	.9	.75	.7	.7	.65	.7	2.1
26	.95	.8	1.55	2.6	2.0	1.0	.7	.65	.65	.65	1.0	2.1
27	.95	1.0	1.6	4.0	1.8	1.1	.65	.7	.65	.65	.8	2.1
28	.95	.85	1.5	3.4	2.0	1.0	.65	.7	.65	.65	.65	.7
29	.9	.....	1.6	2.9	2.5	.95	.65	.7	.65	.65	.6	.65
30	.9	.....	2.1	3.5	2.0	.9	.65	.75	.65	.65	.4	.7
31	.9	.....	3.15	.....	1.85	.....	.65	.7	.....	.65	.....	.7

NOTE.—The creek was frozen at times from January 1 to April 2, the ice reaching a maximum thickness of 1.0 foot. There was also ice during the latter part of November.

Rating table for Silver Creek near Silver Lake, Oreg., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
0.50	7	1.40	50	2.30	120	3.20	217	4.20	380
.60	10	1.50	57	2.40	129	3.30	231	4.40	420
.70	13	1.60	64	2.50	138	3.40	245	4.60	460
.80	17	1.70	71	2.60	148	3.50	260	4.80	500
.90	21	1.80	78	2.70	158	3.60	275	5.00	540
1.00	26	1.90	86	2.80	169	3.70	290	5.20	585
1.10	31	2.00	94	2.90	180	3.80	306	5.40	635
1.20	37	2.10	102	3.00	192	3.90	323		
1.30	43	2.20	111	3.10	204	4.00	340		

NOTE.—This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6 and is well defined.

Monthly discharge of Silver Creek near Silver Lake, Oreg., for 1906.

[Drainage area, 221 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per square mile.	Depth in inches.
January	50	17	24.2	1,490	0.110	0.13
February	78	7	27.8	1,540	.126	.13
March	210	10	40.4	2,480	.183	.21
April	530	57	320	19,000	1.45	1.62
May	245	43	118	7,260	.534	.62
June	167	21	45.8	2,730	.207	.23
July	21	12	15.4	947	.070	.08
August	15	12	12.8	787	.058	.07
September	15	12	12.6	750	.057	.06
October	13	12	12.1	744	.055	.06
November	26	5	12.9	768	.058	.06
December	102	5	20.5	1,260	.093	.11
The year	530	5	55.2	39,800	.250	3.38

NOTE.—The open-channel rating table was applied throughout the year; values for the winter months are probably somewhat in excess of the true discharge on account of ice.

BRIDGE CREEK NEAR SILVER LAKE, OREG.

Bridge Creek rises in western Lake County, Oreg., and flows northeastward into Silver Creek near the town of Silver Lake.

The gaging station was established January 21, 1905, and discontinued July 21, 1906. It was located at the county bridge 2 miles east of Silver Lake, Oreg. The conditions and the bench mark are described in Water-Supply Paper No. 176, page 129.

Discharge measurements of Bridge Creek near Silver Lake, Oreg., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 9	I. Landes	11	7.7	2.39	10
May 29	do	12.5	9.2	2.52	10
June 22	Stevens and Landes	19.5	14	2.74	19

Daily gage height, in feet, of Bridge Creek near Silver Lake, Oreg., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	2.60	2.60	2.50	2.31	2.89	2.65	2.73
2	2.60	2.60	2.60	2.31	3.00	2.65	2.75
3	2.60	2.60	2.50	2.30	2.98	2.66	2.75
4	2.60	2.70	2.50	2.32	2.95	2.67	2.83
5	2.60	2.70	2.50	2.32	3.00	2.70	2.85
6	2.60	2.70	2.50	2.32	2.98	2.70	2.89
7	2.70	2.80	2.50	2.32	2.98	2.75	2.85
8	2.70	2.80	2.40	2.32	3.00	2.8	2.60
9	2.70	2.80	2.40	2.33	2.90	2.83	2.59
10	2.70	2.80	2.40	2.50	2.98	2.75	2.60
11	2.70	2.80	2.50	2.50	2.80	2.75	2.58
12	2.80	2.80	2.50	2.52	2.85	2.76	2.56
13	2.80	2.80	2.60	2.45	2.80	2.76	2.56
14	2.80	2.70	2.60	2.35	2.79	2.76	2.54
15	2.80	2.70	2.60	2.33	2.83	2.76	2.40
16	2.80	2.70	2.60	2.33	2.80	2.75	2.40
17	2.80	2.80	2.60	2.34	2.85	2.78	2.30
18	2.80	2.70	2.50	2.34	2.83	2.79	2.30
19	2.80	2.70	2.40	2.35	2.80	2.80	2.28
20	2.80	2.70	2.40	2.34	2.70	2.82	2.27
21	2.70	2.70	2.40	2.34	2.68	2.82	2.27
22	2.70	2.70	2.30	2.40	2.65	2.80	.....
23	2.70	2.70	2.15	2.50	2.65	2.79	.....
24	2.60	2.70	2.20	2.65	2.64	2.75	.....
25	2.60	2.50	2.40	2.68	2.63	2.75	.....
26	2.50	2.50	2.40	2.70	2.60	2.74	.....
27	2.50	2.50	2.40	2.68	2.64	2.73	.....
28	2.60	2.60	2.40	2.60	2.64	2.70	.....
29	2.60	.....	2.50	2.80	2.63	2.72	.....
30	2.60	.....	2.50	2.85	2.64	2.70	.....
31	2.60	.....	2.50	.....	2.65	.....	.....

NOTE.—Ice conditions January 1–March 7.

Rating table for Bridge Creek near Silver Lake, Oreg., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
2.10	4	2.30	7	2.50	11	2.70	17	2.90	25
2.20	5	2.40	9	2.60	14	2.80	21	3.00	29

NOTE.—This table is applicable only for open-channel conditions. It is based on 3 discharge measurements made during 1906 and is not well defined.

Monthly discharge of Bridge Creek near Silver Lake, Oreg., for 1906.

Month.	Discharge in Second-feet.			Total in acre-feet.
	Maximum.	Minimum.	Mean.	
January	21	11	16.6	1,020
February	21	11	17.1	950
March	14	4	10.4	640
April	23	7	10.5	625
May	29	14	21.3	1,310
June	22	16	18.9	1,120
July (1–21)	25	6	14.0	583
The period	.....	.....	.....	6,250

NOTE.—No correction made in discharge for ice conditions January 1 to March 7. It is probably in excess of the true value.

BEAR CREEK NEAR SILVER LAKE, OREG.

Bear Creek rises in western Lake County, Oreg., and flows northeastward into the western side of Pauline Lake and Marsh.

The gaging station was established January 21, 1905. It is located at the county bridge 3 miles northeast of Silver Lake, Oreg. The conditions and the bench mark are described in Water-Supply Paper No. 176, page 131.

Discharge measurements of Bear Creek near Silver Lake, Oreg., in 1906.

Date.	Hydrographer.	Width.	Area of section.	Gage height.	Discharge.
		Feet.	*Sq. ft.*	*Feet.*	*Sec.-ft.*
April 9	I. Landes	10.5	13	4.48	27
May 29	do	17.5	22	4.87	30
June 22	Stevens and Landes	18.7	29	6.23	65

NOTE.—These measurements were made below the bridge at different sections.

Daily gage height, in feet, of Bear Creek near Silver Lake, Oreg., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
1	4.2	4.2	4.2	4.3	5.1	4.9	5.15
2	4.2	4.2	4.1	4.1	5.2	4.95	5.1
3	4.2	4.0	4.1	4.1	5.3	4.95	5.2
4	4.2	4.0	4.1	4.4	5.35	5.35	5.2
5	4.2	4.0	4.1	4.4	5.4	5.2	5.3
6	4.2	4.0	4.1	4.6	5.4	5.15	5.2
7	4.2	4.2	4.1	4.6	5.45	5.0	5.2
8	4.2	4.2	4.1	4.3	5.5	4.95	5.2
9	4.2	4.2	4.2	4.2	5.6	5.35	5.0
10	4.2	4.2	4.3	4.0	5.8	5.35	5.0
11	4.2	4.2	4.3	4.25	5.9	5.4	5.0
12	4.2	4.2	4.3	4.25	5.65	5.75	4.85
13	4.2	4.2	4.3	4.25	5.4	5.5	4.85
14	4.2	4.2	4.3	4.3	5.4	5.45	4.8
15	4.2	4.2	4.3	4.35	5.3	5.4	4.4
16	4.3	4.2	4.1	4.4	5.3	5.75	4.3
17	4.3	4.2	4.0	4.35	5.2	5.6	4.4
18	4.2	4.4	4.0	4.3	5.1	5.5	4.2
19	4.2	4.4	4.1	4.9	5.0	5.5	4.1
20	4.2	5.0	4.1	5.0	5.2	5.4	.....
21	4.2	5.0	4.1	5.15	5.05	5.4	.....
22	4.2	5.0	4.2	5.2	4.95	5.35	.....
23	4.2	4.4	4.2	5.2	4.7	5.2	.....
24	4.2	4.4	5.15	5.0	4.7	5.2	.....
25	4.2	4.4	5.2	4.95	5.0	5.2	.....
26	4.2	4.4	5.1	4.95	5.1	5.35	.....
27	4.2	4.4	4.6	4.9	5.1	5.5	.....
28	4.2	4.4	4.5	5.0	5.1	5.3	.....
29	4.2	.....	4.4	5.0	5.0	5.05	.....
30	4.2	.....	5.1	5.0	4.85	5.25	.....
31	4.2	.....	4.95	.....	4.9	.....	.....

NOTE.—The creek was frozen from January 1 to about March 20. The thickness of ice was measured as follows: January 5, 13, 20, and 27, February 3, 10, 17, and 24, and March 2, 1.1 feet; March 17, 0.2 foot. There was backwater from the dam of an irrigating ditch after April 19.

ABERT LAKE BASIN.

CHEWAUCAN RIVER AT PAISLEY, OREG.

Chewaucan River rises in south-central Lake County, Oreg., flows northwest, then northeast, and then southeast, and discharges into the south end of Abert Lake. The changes in course are very abrupt.

The gaging station was established January 4, 1905. It is located one-half mile above Paisley, Oreg. The conditions and the bench mark are described in Water-Supply Paper No. 176, page 133.

Discharge measurements of Chewaucan River at Paisley, Oreg., by I. Landes, in 1905–6.

Date.	Width.	Area of section.	Gage height.	Discharge.	Date.	Width.	Area of section.	Gage height.	Discharge.
1905.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*	1906.	*Feet.*	*Sq. ft.*	*Feet.*	*Sec.-ft.*
December 17 [a]	32	57	3.90	40	May 6	52	165	6.60	799
					May 25	47	119	5.72	462
1906.					May 26	43.5	131	5.98	547
April 6	47	147	6.17	567	May 27	42	123	5.80	480
April 7	45	136	5.90	465	June 25	40	97	5.08	293
April 25	45	136	5.98	505					

[a] Measured through ice 0.3 foot thick.

Daily gage height, in feet, of Chewaucan River at Paisley, Oreg., for 1906.

Day.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1	4.3	3.9	4.1	5.3	6.4	5.5	4.9	3.7	3.6	3.6	3.8	3.8
2	4.0	3.9	4.0	5.0	6.5	5.5	4.8	3.7	3.6	3.6	3.8	3.8
3	3.9	3.9	4.0	4.8	6.7	5.6	4.7	3.7	3.6	3.6	3.8	3.7
4	3.9	4.3	4.1	5.0	6.8	6.0	4.7	3.7	3.6	3.7	3.8	3.7
5	3.9	3.9	4.0	5.2	6.9	6.0	4.8	3.6	3.7	3.7	3.8	.....
6	3.9	4.0	4.1	5.94	6.9	6.3	4.7	3.6	3.7	3.7	3.8	4.0
7	3.9	3.9	4.1	6.0	6.8	6.0	4.7	3.6	3.7	3.7	3.9	3.9
8	3.9	3.9	4.2	6.4	6.8	5.8	4.5	3.6	3.7	3.7	3.9	3.9
9	3.9	3.9	4.3	6.5	6.9	6.0	4.5	3.6	3.7	3.7	3.8	3.9
10	3.9	3.8	4.4	6.2	7.0	5.9	4.4	3.6	3.7	3.7	.....	3.9
11	4.0	3.8	4.4	5.8	7.0	5.8	4.3	3.7	.....	3.7	3.8	4.0
12	4.0	3.8	4.0	5.7	6.9	6.0	4.3	3.7	3.8	.....	3.8	3.9
13	4.0	3.8	4.0	5.9	6.6	5.8	4.3	3.6	4.0	3.7	3.8	3.9
14	4.0	3.8	4.1	6.1	6.6	5.7	4.3	3.6	3.9	3.7	3.8	3.9
15	3.9	3.8	4.1	6.1	6.6	5.7	4.2	3.6	3.8	3.7	4.0	3.9
16	4.0	3.8	4.0	6.4	6.3	5.7	4.2	3.6	3.7	3.7	.....	3.9
17	4.1	3.8	4.0	6.5	6.1	5.6	4.3	3.6	3.7	3.7	3.8	3.9
18	4.0	4.0	4.1	6.3	6.0	5.5	4.2	3.6	3.7	3.7	3.8	3.9
19	4.1	4.1	4.1	6.5	5.9	5.5	4.1	3.6	3.7	3.7	3.8	3.9
20	4.2	4.0	4.0	6.7	5.9	5.4	4.1	3.6	3.7	3.7	3.8	3.9
21	4.3	4.1	4.2	6.7	5.9	5.3	4.0	3.6	3.7	.....	3.9	3.8
22	4.1	4.0	4.8	6.7	5.6	5.3	4.0	3.6	3.7	3.8	3.8	3.8
23	4.1	4.0	5.0	5.4	5.6	5.2	4.0	3.6	3.7	3.8	3.7	3.8
24	3.9	4.0	4.9	6.2	5.5	5.1	4.0	3.6	3.7	3.7	.....	4.0
25	3.9	3.9	5.3	6.1	5.5	5.1	3.9	3.6	3.7	3.7	3.8	4.7
26	3.8	3.9	5.3	5.8	6.1	5.4	3.8	3.6	3.7	3.7	3.8	.....
27	3.8	4.3	5.1	5.9	5.8	5.4	3.8	3.6	3.7	3.7	3.8	4.5
28	3.9	4.1	5.0	5.9	5.9	5.3	3.8	3.6	3.7	3.7	3.8	4.3
29	3.8	.....	5.2	6.0	5.7	5.1	3.7	3.6	3.6	3.7	3.8	4.1
30	3.8	.....	6.3	6.3	5.6	5.0	3.7	3.6	3.6	3.7	3.8	4.0
31	3.9	.....	6.5	.....	5.7	.....	3.7	3.6	.....	3.8	.....	3.5

NOTE.—The river was frozen, but not entirely over, January 1 to February 12, average thickness of ice, 0.5 foot; also December 15 to 31.

Rating table for Chewaucan River at Paisley, Oreg., for 1906.

Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.	Gage height.	Discharge.
Feet.	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*	*Feet.*	*Sec.-ft.*
3.50	23	4.30	112	5.10	284	5.90	503	6.70	838
3.60	29	4.40	129	5.20	309	6.00	535	6.80	890
3.70	36	4.50	148	5.30	335	6.10	569	6.90	945
3.80	45	4.60	168	5.40	361	6.20	606	7.00	1,000
3.90	56	4.70	189	5.50	387	6.30	647		
4.00	68	4.80	211	5.60	414	6.40	692		
4.10	81	4.90	235	5.70	442	6.50	739		
4.20	96	5.00	259	5.80	472	6.60	788		

NOTE.—This table is applicable only for open-channel conditions. It is based on discharge measurements made during 1905-6 and is well defined.

Monthly discharge of Chewaucan River at Paisley, Oreg., for 1906.

[Drainage area, 272 square miles.]

Month.	Discharge in second-feet.			Total in acre-feet.	Run-off.	
	Maximum.	Minimum.	Mean.		Sec.-ft. per sq. mile.	Depth in inches.
January	112	45	65.4	4,020	0.241	0.28
February	112	45	62.1	3,450	.228	.24
March	739	68	173	10,600	.636	.73
April	838	211	551	32,800	2.03	2.26
May	1,000	387	671	41,300	2.47	2.85
June	647	259	415	24,700	1.53	1.71
July	235	36	110	6,760	.405	.47
August	36	29	30.4	1,870	.112	.13
September	68	29	37.1	2,210	.136	.15
October	45	29	35.2	2,160	.129	.15
November	68	36	46.8	2,780	.172	.19
December	189	23	66.7	4,100	.245	.28
The year	1,000	23	189	137,000	.694	9.44

NOTE.—The open-channel rating table has been applied throughout the year; values for the winter months are liable to some error on account of ice. Discharges interpolated for days on which gage was not read.

MISCELLANEOUS MEASUREMENTS.

The following measurements were made of minor streams of the Great Basin, in 1906, by J. F. Hoyt and others.

Miscellaneous measurements in Great Basin in 1906.

Date.	Stream.	Locality.	Area of section.	Mean velocity.	Gage height.	Discharge.
	IN UTAH.					
1906.			*Sq. ft.*	*Feet per sec.*	*Feet.*	*Sec.-ft.*
June 4	North ditch of Nephi Irrigation Co.	¼ mile north of San Pedro depot.	5.1	1.77	.....	9.07
Aug. 3	Rating flume	Wilson canal	14.9	.95	.....	14.2
June 26	Indian Creek	Above head of T. F. & B. Co	5.3	2.97	.....	15.6
27	Wildcat Creek	E. Gillie's ranch	1.2	1.84	.....	2.25
27	Pine Creek	G. Bradshaw's ranch	3.4	2.70	1.4	9.06
28	Kesler ditch	(Containing water of Cove Creek).	.48	1.25	1.0	.61
28	North Fork Pine Creek	Below county road crossing.	1.1	1.84	.7	1.97
July 4	Hutchins and Thompson ditch.	125 feet below head	1.8	1.44	.....	2.58
4	Beaver City irrigation canal.	In flume	9.8	3.10	.....	30.3
4	Harris ditch	Beaver City canal flume	7.9	3.25	.....	25.6
4	Beaver City power canal	Near Harris ditch	5.7	2.44	.....	13.8
6	North Fork South Creek	Cox Bros. ranch	.77	.47	.....	.36
6	Birch Creek	Above mouth Lower Birch Canyon.	2.3	1.4	.....	3.28
11	A. Bayter's dug well and springs.	.....	.42	.30	.....	.11
12	N. Green's springs	Near fence No. 48	.25	.99	.....	.25
13	G. B. and D. M. Gillie's springs.	SE. ¼, sec. 4, T. 29 S., R. 7 W.	.....	.....	.....	.82
13	2 springs forming part of Dry Creek.	On Hannah Gales's farm	1.47	.92	.....	1.35
13	2 springs forming part of Dry Creek.	In O. W. Gales's pasture	.....	.....	.....	.68
14	Farnsworth and Bastian Bros.' springs.	On Indian Creek	.....	.....	.....	.11
20	Jeddy Dean's dug well	Beaver City [a]	.26	.94	.....	.25
20	J. H. Cartwright spring	Beaver City [a]	.11	.42	.....	.05
20	W. E. Yardley's 2 springs	Beaver City [a]	.34	.67	.....	.23
20	Part of seepage water	E. Willden's yard [a]	.....	.....	.....	6.72
23	Remainder seepage water	E. Willden's yard, Beaver City. [a]	.....	.....	.....	1.30
	Total	.....	.....	.....	.....	8.02
	Discharge of surface stream.	.....	.....	.....	.....	.06
	Seepage	.....	.....	.....	.....	7.96
23	Irrigation ditch	Beaver City [b]	3.09	1.38	.....	4.23
23	Irrigation ditch	Beaver City [c]	2.17	1.86	.....	4.04
28	Jos. Jacksons's 2 springs	South Beaver	.53	.69	.....	.37
31	North Fork South Creek [d]	Cox Bros. ranch	.51	.50	.....	.25
31	South Fork South Creek	Cox Bros. ranch	.....	.....	.....	2.81
31	Birch Creek (Estimated)	.....	.....	.....	.....	2.00
	Total	.....	.....	.....	.....	5.06
Aug. 21	Datson's warm springs	1 mile east of Minersville	.....	.....	.....	.13
25	Birch Creek	Mouth Lower Birch Creek Canyon.	.....	.....	.....	.93
25	North Fork South Creek	Cox Bros. ranch	.44	.34	.....	.15
	IN OREGON.					
Apr. 8 [e]	Ana River	Summer Lake	52	.....	3.46	141
May 31	Choctoo Creek	Sycan Marsh	16	.....	.....	24
31	Coyote Creek	....do	2.9	.....	.....	4.5
31	Long Creek	....do	39	.....	.....	60
July 2 [f]	Silvies	Silvies	127	.....	3.88	89

[a] Mr. Deans's well flows rarely, even during the high water season. It is situated at the foot of a low beach in what has been a belt of marshy ground during high water seasons. In this belt are a dozen such wells and cellars discharging similar streams, some of them being given above.

[b] Ditch flows west on street 3 blocks north and 2 blocks west of W. M. & Co.'s store, measured at schoolhouse corner.

[c] Same ditch as at point 40 feet west of street 3 blocks east of Main street.

[d] This discharge is about twice the mean daily discharge, the flow almost ceasing at times.

[e] The discharge of this stream remains practically constant at 140 to 150 second-feet, as it heads in large springs; see Water-Supply Paper No. 176. p. 132.

[f] Measured from cable at station described in Water-Supply Paper No. 176. p. 122.

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